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Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Volume 1 AUGUST, 1930 Number 12

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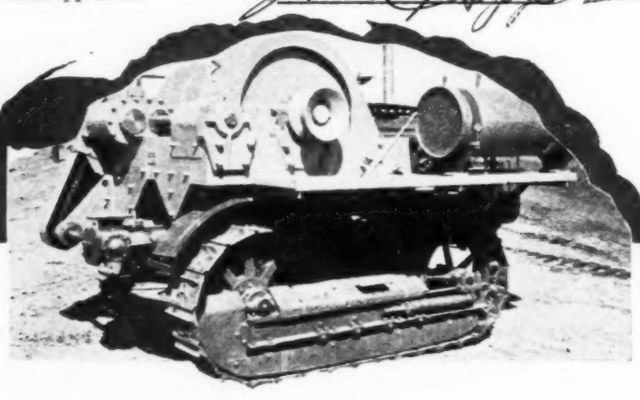
F.A.Hopper:HH By F A Hopper



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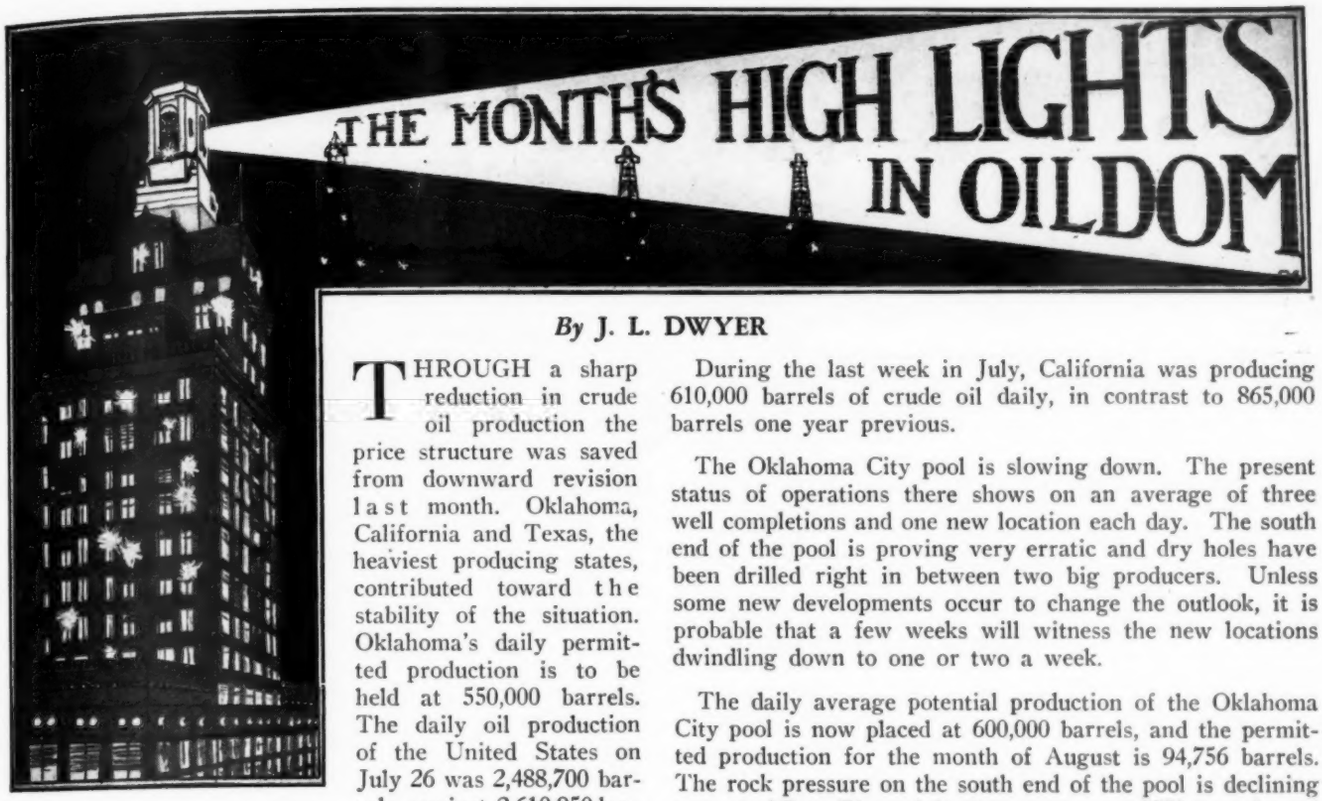


By J. L. DWYER

THROUGH a sharp reduction in crude oil production the price structure was saved from downward revision last month. Oklahoma, California and Texas, the heaviest producing states, contributed toward the stability of the situation. Oklahoma's daily permitted production is to be held at 550,000 barrels. The daily oil production of the United States on July 26 was 2,488,700 barrels, against 2,610,950 barrels one month previous, and 2,896,650 barrels in July, 1929.

The daily potential production of Oklahoma is now placed at 1,351,681 barrels, and it is by order of the state Corporation Commission this is to be held to 550,000 barrels. With pipe line companies unwilling to connect new wells, the seriousness of the situation is appreciated by all in the industry.

The Hobbs field in New Mexico continues to grow in importance. The method of gauging the wells in this field was changed by the advisory committee on August 1. The method formerly used was to take a three-hour gauge through tubing, the last two hours of which were used as a basis of computing the 24-hour total. The open flow method will be used in establishing future gauges.

The Darst Creek field in Texas has overthrown proration and some legal complications have developed.

During the last week in July, California was producing 610,000 barrels of crude oil daily, in contrast to 865,000 barrels one year previous.

The Oklahoma City pool is slowing down. The present status of operations there shows on an average of three well completions and one new location each day. The south end of the pool is proving very erratic and dry holes have been drilled right in between two big producers. Unless some new developments occur to change the outlook, it is probable that a few weeks will witness the new locations dwindling down to one or two a week.

The daily average potential production of the Oklahoma City pool is now placed at 600,000 barrels, and the permitted production for the month of August is 94,756 barrels. The rock pressure on the south end of the pool is declining very rapidly. The original pressure was 2250 pounds and in the south end of the pool this figure is now averaging about 500 pounds, while in the north end of the field it shows an average of approximately 1,750 pounds. The completed wells in the field number 410 and there are now 300 active drilling operations.

Oil and gas pipe line construction constitutes the most active phase of the industry at present, and various projects are being rushed to completion in advance of unfavorable weather conditions. Work has started on the Gulf oil line which will run from the Mid-Continent field to a point near Pittsburgh. The Ajax Pipe Line Co. (Standard Oil Co., New Jersey) is also making good progress. It is possible that the completion of these lines may result in the construction of new refineries.

The Great Lakes Pipe Line Co.'s gasoline line has been started. It is owned by the Continental Oil Co. and the Barnsdall Oil Co.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending July 26, 1930

(Figures in Barrels of 42 Gallons)

DISTRICT	Per Cent Potential Capacity Reporting	Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	3,421,000	80.3	7,354,000	9,757,000
Appalachian	91.8	545,000	66.2	1,467,000	1,042,000
Ind., Ill., Ky.	99.6	2,071,000	77.7	7,363,000	4,403,000
Okla., Kan., Mo.	89.9	1,971,000	67.7	3,837,000	4,671,000
Texas	90.4	4,078,000	81.7	6,476,000	10,182,000
Louisiana, Arkansas	96.8	1,154,000	62.9	1,977,000	1,927,000
Rocky Mountain	93.6	384,000	39.4	2,481,000	1,204,000
California	99.3	4,006,000	64.2	13,796,000	106,083,000
Total Wk. July 26	95.7	17,630,000	71.4	44,751,000	139,269,000
Total Wk. July 19	95.7	17,122,000	69.3	45,937,000	139,113,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts.					
Texas Gulf Coast	100.0	3,009,000	81.7	5,253,000	7,155,000
Louisiana Gulf Cst.	100.0	743,000	71.9	1,589,000	1,068,000

Daily Average Production

(Figures in Barrels)

	July 26, 1930	June 28, 1930	July 27, 1929
Oklahoma	566,850	666,950	726,500
Kansas	117,050	134,200	126,700
Panhandle Texas	96,400	108,000	93,000
North Texas	74,550	81,800	86,600
West Central Texas	55,400	61,000	58,800
West Texas	298,650	307,350	395,250
East Central Texas	40,900	40,100	17,700
Southwest Texas	77,350	78,100	77,700
North Louisiana	42,150	40,200	36,100
Arkansas	55,450	57,300	68,200
Coastal Texas	185,900	187,000	126,000
Coastal Louisiana	26,450	25,900	19,400
Eastern (not including Mich.)	126,500	126,000	102,800
Michigan	9,850	10,100	21,000
Wyoming	48,100	48,800	54,500
Montana	9,350	9,450	11,400
Colorado	4,700	4,850	6,850
New Mexico	42,200	26,550	2,550
California	610,900	597,300	865,600
Total	2,488,700	2,610,950	2,896,650

Boiler Feed Water Theories *and* Applications

By **A. J. SCHLOSSER,** *General Supt., Natural Gasoline Division, Barnsdall Oil Company*

AT several of the Barnsdall gasoline plants, we have had considerable trouble in regulating the water treatment so as to not give large deposits of scale in the boilers, water jackets, etc. As a result, I have attempted to give the general routine of tests for boiler feed water analysis, an explanation of the meaning of the tests, and method of calculation by which the operator will be able to regulate his boiler feed water treatment.

A. J. Schlosser

I. IMPURITIES IN NATURAL WATER:

In a chemical sense, all natural water is to some degree impure. Even rain water, which is the purest form, contains solid matter, both organic and mineral, obtained by washing out the wind-raised dust from the air. All water obtained from the earth, whether from the surface or lower depths, contains dissolved substances taken up from the rocks and soils with which they have been in contact. Water from very low levels, as from deeply bored wells, is likely to contain larger quantities of dissolved substances than surface water, because of the great mass of rock through which it has percolated. In general, water from regions of granite, sandstone and clay contains less dissolved mineral matter than from limestone regions. Besides the dissolved substances, water may carry suspended matter such as silica, clay, organic matter, etc. This is especially true of surface water such as those from rivers and other streams.

In oil field water treatment, we must meet conditions that are unlike any others met in water treatment. This is because there are sub-surface waters from the oil wells polluting the surface water. In general, the chlorides and sulphates from the oil wells, and the carbonates, bicarbonates and silicas from the surface water have to be overcome in treating the water.

II. HARD WATER:

Water that contains dissolved calcium, magnesium and iron compounds, generally as the sulphates and bicarbonates, is known as "hard water". However, this term is quite often used loosely for waters containing acid or any water that will destroy soap. Soap reacting with the calcium, magnesium and iron compounds form sticky, insoluble, curdy soaps of these metals. For example, the reaction of sodium stearate, an ordinary sodium soap, with calcium sulphate is as follows:

$$2\ Na\ (C_{18}H_{35}\ O_2) + Ca\ SO_4 = Ca\ (C_{18}\ H_{35}\ O_2) + Na\ SO_4\ (1)^*$$

Soap + Calcium Sulphate + Calcium Stearate = Sodium Sulphate.

The soap continues to react with such salts in this manner until they have been thrown out of solution. The soap cannot form a lather.

The hardness of water is generally recognized as being of two kinds: That which is removable by boiling is said to be temporary, and that which persists after boiling is said to be permanent.

Temporary hardness is caused by the presence of bicarbonates, especially of calcium, but also of magnesium and iron. The normal carbonates of these metals are practically insoluble in water alone, but in water that contains carbon dioxide, they are converted into their corresponding bicarbonates, which are much more soluble compounds. Consequently, water coming from limestone regions where much organic matter (decaying material) also exists, will likely contain much of this sort of hardness. The organic matter upon decaying produces carbon dioxide, and this in the presence of water produces carbonic acid which acts on the limestone as follows:

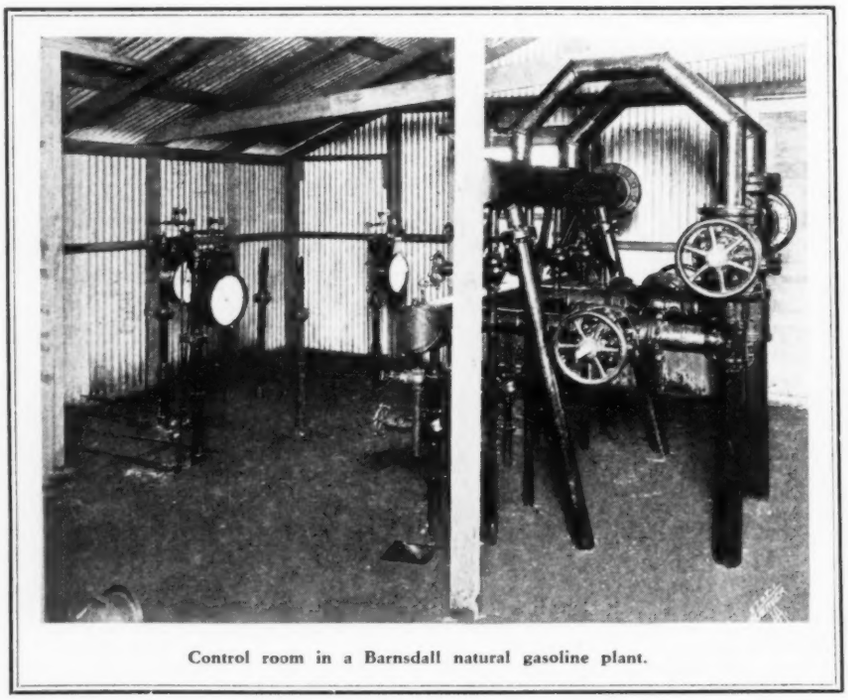
$$H_2O + CO_2 = H_2\ CO_3 \qquad (2)$$

Water + Carbon Dioxide = Carbonic Acid.

$$Ca\ CO_3 + H_2\ CO_3 = Ca\ (HCO_3)_2.$$

Limestone + Carbonic Acid = Calcium Bicarbonate (3). (Soluble Limestone).

Following this reasoning, it is quite easily understood why that after rains, the hardness of the water increases. The sulphates are more pronounced at this period of atmospheric conditions in the oil fields, due to their being carried into the surface waters with the silicas or sediment. I have run tests on water after rains which would lead one to doubt the validity of



Control room in a Barnsdall natural gasoline plant.

*Indicates an excess of one to be reacted with by the other.

the above statements. It is to be remembered that the excess of rain water or surface water may be soft enough to dilute the total hardness of the water. However, as soon as the surface water becomes normal again, the decaying matter washed in by the rain causes the hardness of the water to increase rapidly, as the above reaction indicates.

Permanent hardness is caused by the sulphates of calcium, magnesium and iron, especially the sulphates of calcium.

Solubilities in Parts Per Million

Substance	In Water @ 60°	Water with CO_2 @ 60°	In Water @ 212°
Calcium Carbonate.....	12	1100	21
Magnesium Carbonate....	385	27500	Nearly 0

III. Acidity of Water:

The streams fed by tributaries that carry drainage from oil wells, or the refuse from them, may contain free sulphuric acid. The acid is produced by the wet oxidation of such sulfites as marcasite or iron pyrite ($Fe S_2$) as follows:

$4 Fe S_2 + 15 O_2 + 6 H_2O = Fe (6A) SO_4 + 4 H_2 SO_4$.

Iron Pyrite + Oxygen + Water = Iron sulphate + Sulphuric Acid.

IV. Treatment of Boiler Water:

The scale forming tendencies of water may be overcome by suitable treatment. As a rule, the water is treated either by hot or cold water softening. Hot water softening consists of precipitating the dissolved substances in equipment which is easily cleaned. This type of equipment can only be economically used around large power plants where there is an excess of waste steam.

Cold Water Softening: Cold water softening is the type of treatment which is of more interest to the operators of water treating plants in the oil industry. In this process, the soluble bicarbonates, sulphates, and chlorides are removed by converting them into the more insoluble normal carbonates and hydroxides by the use of "soda ash" (sodium carbonate) and lime. In order to convert the bicarbonates into the normal form, it is necessary to neutralize the carbonic acid present; providing there is any, before any of the metal bicarbonates $Ca (HCO_3)_2$ can be taken out.

For the removal of the above, the reactions are as follows:

$Ca O + H_2O = Ca (OH)_2$. (5)

Hydrated lime + Water = Calcium Hydroxide (Slacked Lime).

$H_2 CO_3 + Ca (OH)_2 = Ca (HCO_3) + 2 H_2O$. (6)

Carbonic Acid + Lime = Calcium Bicarbonate + Water.

After the above reactions have been completed, the reaction of the lime and bicarbonate is as follows:

$Ca (H CO_3)_2 + Ca (OH)_2 = Ca CO_3 + 2 H_2O$. (7)

Calcium bicarbonate + lime = Calcium carbonate and water.

I have been asked by operators on several occasions as to what part the "soda ash" ($Na_2 CO_3$) played in the treatment of water. The sulphates and magnesium salts are the only things that the "soda ash" acts on. The reaction of the sulfates is as follows:

$Ca SO_4 + Na_2 CO_3 = Ca CO_3 + Na_2 SO_4$. (8)

Calcium Sulfate + Soda Ash = Calcium Carbonate + Sodium Sulfate.

Thus it can be seen that the sulfates are converted to carbonates which are not very soluble in water as a preceding table shows.

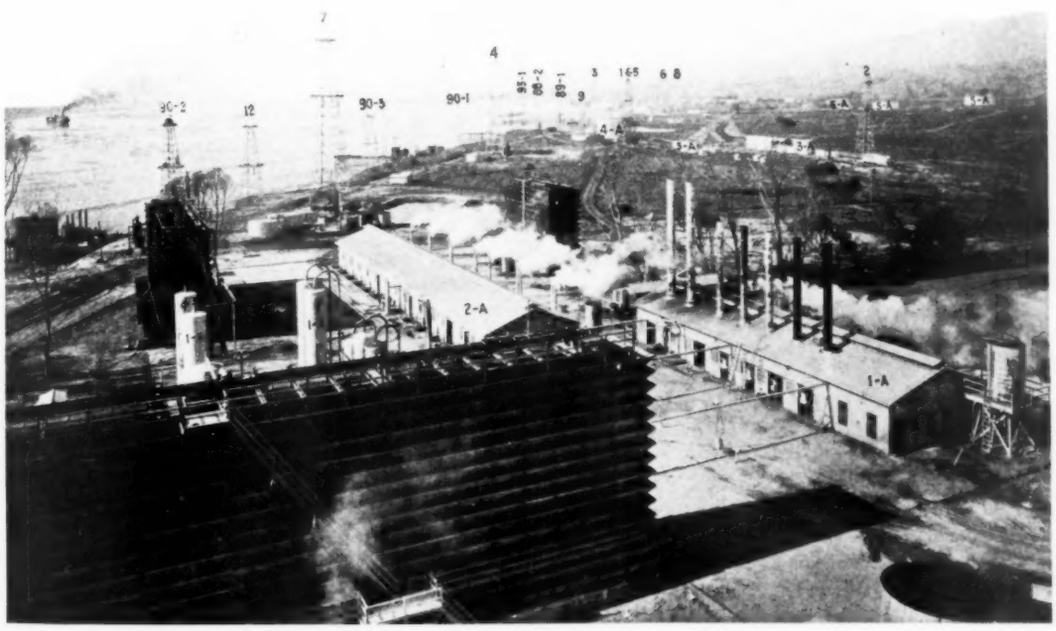
The dissolved magnesium salts are converted into magnesium hydroxide according to the following equations:

$Ca (OH)_2 + Na_2 CO_3 = Na OH + Ca CO_3$. (9)

Lime + Soda Ash = Sodium hydroxide + Calcium carbonate (limestone).

The dissolved magnesium salts are converted into magnesium hydroxide according to the following equations:

$Ca (OH)_2 + Na_2 CO_3 = 2 Na OH + Ca CO_3$. (10)



The discovery and development of a number of new prolific properties in California has led to a large increase in the activities of the Barnsdall Oil Company of California. An idea of the great activity can be gathered from this picture of the lease at Elwood. Explanations of the key numbers are as follows: Nos. 1 and 5, Luton-Bell wells Nos. 1 and 5; No. 2, Luton-Bell well No. 2; No. 3, Luton-Bell well No. 3; No. 4, Luton-Bell well No. 4; No. 6, Luton-Bell well No. 6; No. 7, Luton-Bell well No. 7; No. 8, Luton-Bell well No. 8; No. 9, Luton Bell well No. 9; No. 12, Luton-Bell well No. 12; Nos. 88-2, 89-1, 90-1, 90-2, 90-3, 93-1, Tideland Permit wells; 1-A, Elwood Absorption Plant; 2-A, Elwood Compressor Plant; 3-A, Luton-Bell Shipping Tanks; 4-A Water Tank; 5-A, Oil Storage Tanks; 6-A, Tanker loading from 10-inch Ocean Loading Line.

Lime + Soda Ash = Sodium Hydroxide + Calcium Carbonate.

$Mg(HCO_3)_2 + 2\ Na\ OH = Mg(OH)_2 + Na_2CO_3$. (11)

Magnesium Bicarbonate + Sodium Hydroxide = Mag. Hydroxide + Sodium Carbonate.

$Mg\ SO_4 + 2\ Na\ OH = Mg.(OH)_2 + Na_2SO_4$. (12)

Mag. Sulfate + Sodium Hydroxide = Mag. Hydroxide + Sodium Sulfate.

The first of the above reactions shows the lime and soda ash forming the sodium hydroxide to act on the magnesium bicarbonates and sulfates. The sodium salts formed by the use of soda ash, being soluble, remain in the water and although they do not contribute directly to the formation of scale, they do cause foaming of boilers. Thus, if the permanent hardness is too great, the extraction of all the permanent hardness is not practical due to the foaming caused.

In order to more effectively remove the suspended solids, including the products of the reaction and such, the so-called "coagulum" method may be employed. In this process, dissolved aluminum sulfate, or ferrous sulfate, is introduced with the soda ash and slacked lime. A flocculent, gelatinous precipitate consisting of the hydroxide of the metal is formed as is illustrated by the following:

$Al_2(SO_4)_3 + 3\ Na_2CO_3 + HO_2 = 3\ Na_2SO_4 + 2\ Al(OH)_2 + 3\ CO_2$. (13)

Aluminum sulfate + Soda Ash = Sodium sulfate and aluminum hydroxide.

As the precipitate settles, the suspended matter is carried down with it and leaves the clear water.

> ***"As might be expected, almost every desirable property of gasoline—for example, high volatility, high anti-knock, low sulfur content, low gum content, etc., cost money to obtain and are bound to be ultimately reflected in the cost of gasoline to the consumer. In many cases the intelligent co-operation of the automotive engineer will markedly decrease the need for such stringent specifications or prevent the trouble which may result if the specification limits are exceeded, and such co-operation is certainly to the advantage of both industries and of the general public."***
>
> ***R. E. Wilson,***
>
> **Assistant to Vice-President in Charge of Manufacturing, and Head of Development and Patent Dept., Standard Oil Co. (Ind.).**

V. Methods of Analysis and Application:

Equipment and Reagents: The equipment used is two 25 cc. burrettes, one 200 cc. evaporating dish, 4-ounce sample bottle and a glass stirring rod. The reagents used are as follows: N/50 sulphuric acid, standard soap solution, methyl orange and phenolphthalein as indicators for the titration. The total cost of this equipment and reagents should not exceed ten or twelve dollars.

Conversion Factors: There are two general ways of specifying the hardness of water. They are as follows:

(1) Parts per million (p. p. m.). This method is generally used by chemists and municipal water plants because of the ease of calculation of treatment.

(2) Grains per U. S. gallon. To convert grains per gallon into p. p. m., multiply by 17.1. To convert p. p. m. into grains per gallon multiply by 0.0584.

VI. Tests for Total Alkalinity:

The alkalinity of a water indicates the presence of certain salts in solution, which have the power to neutralize acids. The most common alkaline salts are known as carbonates, bicarbonates and hydrates.

It is desirable for the plant engineer to know not only the total alkalinity of his water, but the amount of each kind of alkalinity.

Total alkalinity as the term implies means the total amount of alkaline salts present. Place 100 cc. of the water to be tested in a porcelain evaporating dish having a capacity of approximately 200 cc. Add two to four drops of methyl orange indicator, which is to be referred to later as M, and stir with a glass rod. The color of the water after adding the indicator will be yellow. If it turns red, the water under test is acid. When the water is alkaline, add 1/50 normal sulphuric acid (marked N/50 H_2SO_4) drop by drop from a glass burrette, stirring the water after each addition of acid until it changes from yellow to a faint pink, then read the burrette and determine how much acid was used to bring about this change. Each cubic centimeter of acid used is equivalent to 10 p. p. m. of alkalinity.

Example: Suppose 100 cc. H_2O requires 4.2 cc. of acid, then $4.2 \times 10 = 42$ parts per million of total alkalinity.

VII. Tests for Carbonate, Bicarbonate and Hydrate Alkalinity:

To determine carbonate, bicarbonate and hydrate alkalinity, a second test must be made as follows:

Place 100 cc. of the water to be tested in the porcelain evaporating dish and add two to four drops of phenolphthalein which is later referred to as P. If the color of the water remains white after the addition of the indicator P., all the total alkalinity in the test with the M. indicator is present as bicarbonates. If the water turns red after the addition of the phenolphthalein indicator, add N/50 H_2SO_4 as in the test for total alkalinity and determine how much acid is required to change the color from red back to white:

Example: Suppose 2.7 cc. were required to bring about this change, then P. alkalinity would be $2.7 \times 10 = 27$ p. p. m.

The various forms of alkalinity may be calculated from the formulas given in the following table:

	Bicarbonates	Carbonates	Hydrates
P = 0	M	0	0
P less than ½ M	M-2P	2 P	0
P = ½ M	0	2 P	0
P greater than ½ M	0	2 (M-P)	2P-M
P =	0	0	M

The above table is explanatory in itself. The bicarbonates indicate the need of an increase of lime. The hydrates indicate the excess of soda ash or the amount of magnesium or calcium carbonate.

VIII. Soap Test for Total Hardness:

On this test, I believe it advisable to use 58-1/3 cc. of water for a sample, since most of the standard soap solutions are standardized for this amount of water sample. This gives the hardness in grains per gallon which can be converted into p. p. m. by multiplying by 17.1.

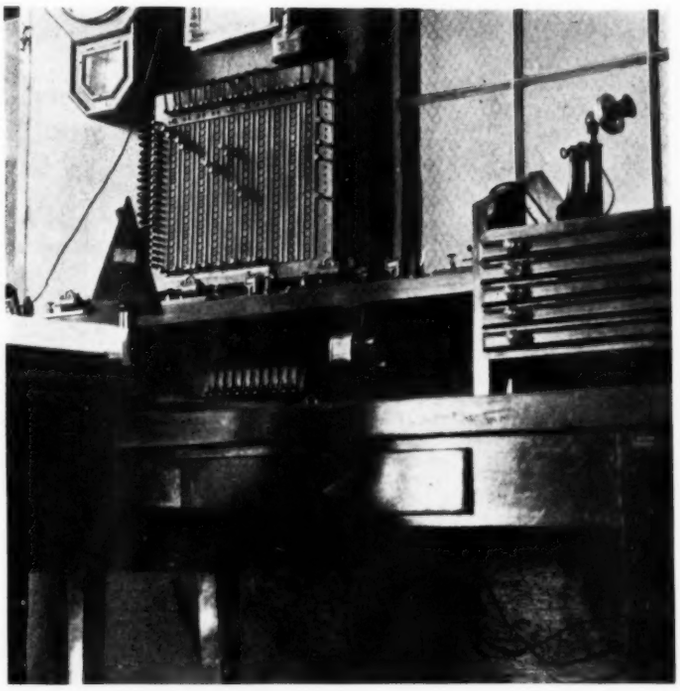
The test is carried on as follows: Place 58-1/3 cc. of sample to be tested in a clean, 4-ounce bottle. Add .5 cc. of the standard soap solution at a time and shake the sample vigorously after each addition. Continue this until a firm lather remains for a period of three minutes. Take the number of cc. which were required and deduct the lather factor (usually 0.5). This gives the hardness in grains per gallon.

Calculation of treatment: Coagulation treatment—½ pound of sodium aluminate per 1,000 gallons is the normal amount recommended when using it for a coagulent. This is approximately ½ gallon for 250 barrels.

Important Factors in

Pipe Line Communication Systems

By COLONEL CLAUDE MITCHELL, *Humble Pipe Line Co.*



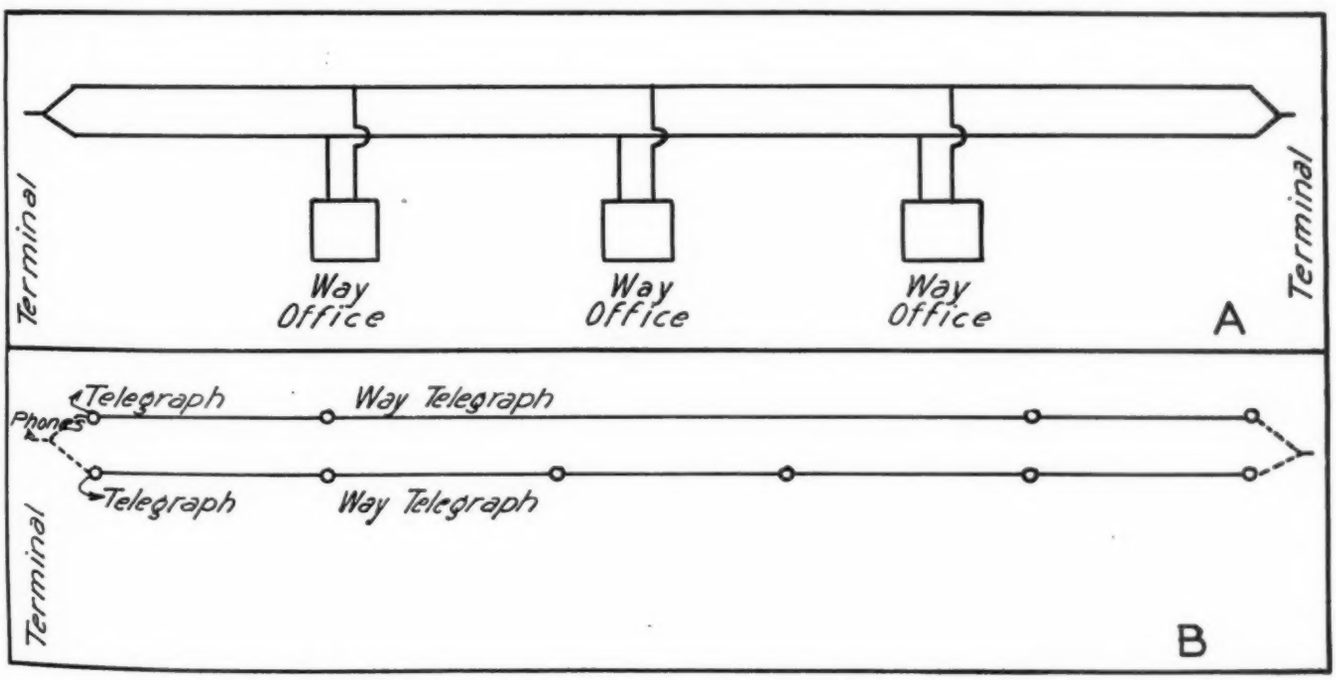
Instrument board in a pipe line station.

MANY pipe line executives do not have the time, nor opportunity, to pursue a technical study of the problems of communication, yet they wish a simple, practical discussion of the subject.

When details are completed providing a right-of-way for the pipe line, construction of a pole line should begin and be carried forward ahead of or at least with the construction of the pipe line. Such an arrangement will provide the field men contact with headquarters and the countless needs of the construction work furnished with minimum delay. Much money is saved by having your own system always available and not having to depend upon commercial companies for service.

It is suggested pole lines be constructed of the best material available, using thirty-five poles to each mile, ordinarily, poles 25 feet high with longer poles for highway and railroad crossings. It is very important that the treatment be forced into the wood with enough pressure to insure uniformity throughout, otherwise you will have a pole with a rotten heart and no strength. Using not more than two wires with no expansion contemplated—oak brackets are sufficient for wire attachment, more than two wires cross arms should be used.

It is not a difficult matter to make a pole line survey and estimate what, when completed, will be permanent and serve any pipe line. It is in the terminals and offices that experienced engineers and installers are necessary. The required number of poles, miles of wire, insulators, brackets or cross arms, guy wires for corners and curves, nails for brackets, or bolts and braces for cross arms, extra length poles for



crossings should be available and ready for distribution upon arrival of the construction forces. The average pipe line communication system is used by all departments of the oil company and for this reason it is better business to provide for a more elaborate plant than the one used to service the pipe line alone. At the time crude oil reaches the casing-head it requires co-ordinating communication, into the field lines to the settling tanks, thence in the main pipe line to refinery, tank farm or ocean terminal.

Telegraph personnel may be provided with small additional pay roll cost, the average telegrapher usually makes an excellent gauger, clerical help, and many other duties may be assigned him. Some pipe lines train their telegraphers to take care of oiling and engineering duties, in fact, many pump stations are being operated by these "combination" men most satisfactorily.

Each pipe line has its individual requirements from a communication standpoint, however, by adding to or eliminating one of the following basic plants discussed the answer to your problem may be had. The length of the pipe line, the volume of transport, the terrain traversed, operating data required and the location of the general offices with reference to the pipe lines control the size of the telegraph and telephone installations.

For use in connection with the gathering, very short lines or interfield service:

Two (one pair) of wires, a wall or desk set for each office to be operated. A system of call signals, this small plant to be used just as the old-fashioned party lines were. One pipe line company operates 136 miles of 10-inch very efficiently with this type of service. See drawing "A".

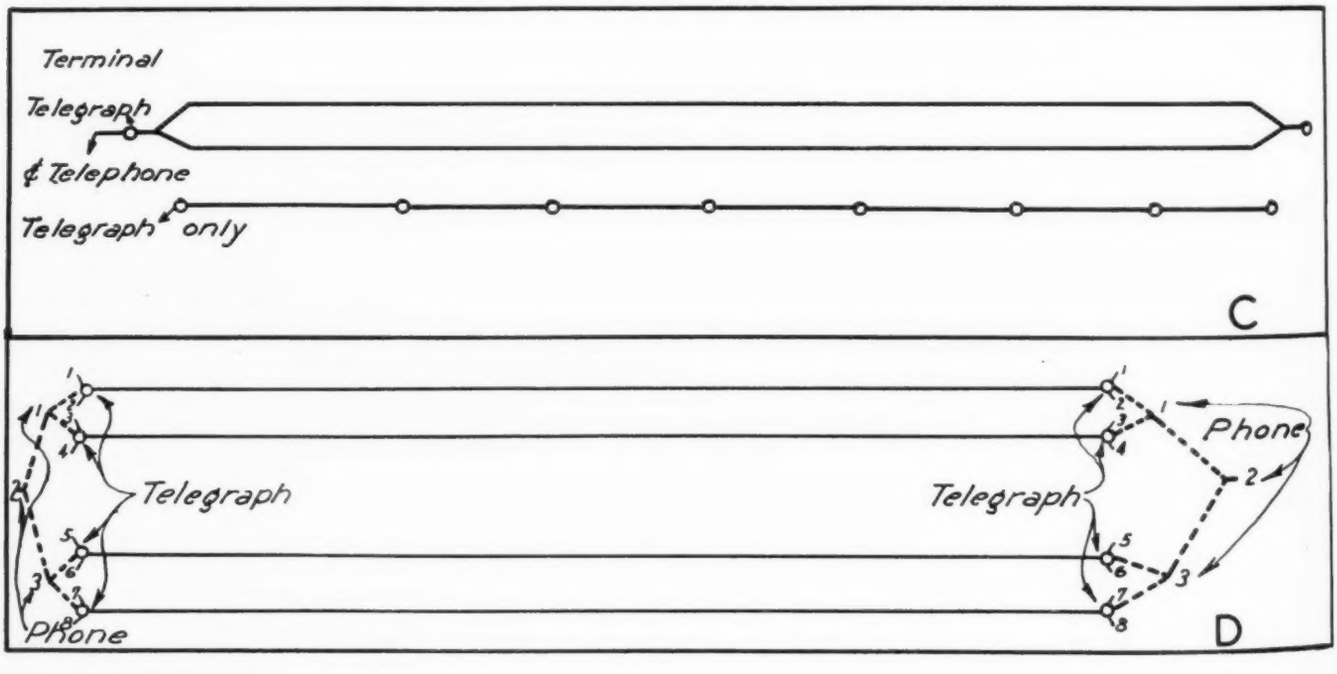
Any number of intermediate offices may be used, however, the volume of business originating from more than 12 usually requires additional facilities.

The plant in drawing "B" provides for both telegraph and telephone service. Two wires should be used. The telephone circuit is metallic, two telegraph circuits are furnished through the use of composite coils and the necessary condensers at the terminals. Intermediate offices may be served, care should be taken, however, to see that there are not too many way offices used in this character of plant. Due to resistance of the various office instruments too many will drain the circuit of its electro motive force and it will not give satisfactory results, however, the method is very satisfactory and in use by a large number of pipe line, railroad, telephone and telegraph companies. Sketch "C" requires three wires and may be used where telephone in volume is needed between terminals as well as telegraph. The third wire in this case being used for telegraph way service only. It is possible to extend the telephone service to the way stations also if desired. This plant gives us one telephone and two telegraph circuits. Such arrangement will take care of a large volume of business and many pipe lines use this plan. The telegraph on the telephone circuit is made possible by the use of simplex coils.

The arrangement of plant "D" is for four wires so arranged to give three telephone circuits and four telegraph circuits. On each telegraph circuit we may transmit two telegrams by using duplex instrument assemblies. Should the traffic demand it we can increase each telegraph circuit to four telegrams or more. All of this work may be done simultaneously without interference. Assuming we equip our four telegraph circuits with duplex in each of our terminals we may use eight telegraphers or a total of sixteen people for telegraph. Our three telephone circuits use a total of six people for both terminals, so we have facilities to take care of the efforts of a total of 22 persons transmitting 11 messages at the same time and we believe in the most satisfactory manner yet devised. This plant, with the proper assembly of instruments, will take care of the communication traffic of any pipe line.

Telegraph power may be obtained from any alternating current furnishing light or power of standard voltage. This is done by using small generators propelled by alternating current and furnishing direct current for telegraph. Most pump stations are equipped with the necessary power to do this or a light circuit available that may serve. In isolated cases it may be necessary to provide battery for power, however, practically all of the territory occupied by pipe lines has been or will be wired.

Are you getting maximum results from your present plant? After a few years the average plant becomes a matter of course and is sometimes permitted to remain dormant. The evolution of communication equipment has been so very rapid we frequently find ourselves behind the parade and not availing ourselves of the best available. Our present plants may perhaps give us double capacity by the addition or change of a few instruments, rearrangement of circuits, rerouting of traffic or the construction of an additional wire.



Control Instruments in the Monroe Gas Field

By V. F. SACKETT [1]

THE Southern Carbon Company has 150 producing gas wells in the Monroe and Richland Parish gas fields which vary in rock pressure from 100 to 1030 pounds per square inch, with a daily open flow varying from 1 to 40 million cubic feet. The total open flow of gas from our wells is in excess of one billion cubic feet per day. In addition to our wells gas is being purchased from 110 wells from acreage in the field.

In former years practically all the gas produced was used in the manufacture of carbon black after the gasoline was extracted. At this time the greater portion of the gas is delivered to pipe lines supplying gas for industrial and domestic use in Alabama, Louisiana, Missouri, Tennessee and Texas.

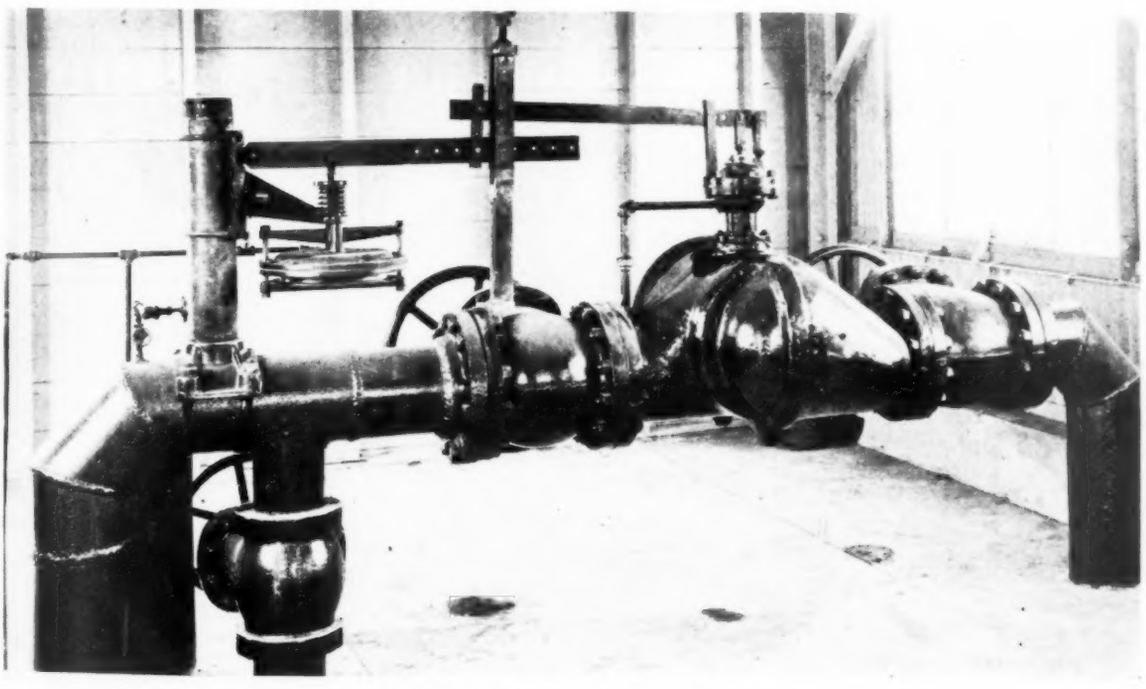
On account of the general topography of the country, access to the wells is difficult during certain times of the year. Much of the land is flooded; therefore, the field men must travel on foot, horseback or by boat. The gas department of this company has worked out scientific methods of automatic control for the gathering system from the wells and the distribution of the gas to the pipe lines, which has resulted in very efficient and economical operation. Flexibility in meeting fluctuating load demands, constant line pressures for gasoline or carbon black plant operation, and accurate records of distribution are some of the advantages of the installations.

Due to the author's extensive experience in the natural gas industry, this article is of great interest to operating men. It is a most comprehensive treatise on the use of instruments for remote control of gas production. This company has in operation one of the most scientific systems of control and regulation of gas from the wells to the pipe lines to be found anywhere. The system described lends itself to great flexibility and accuracy of control.

Rate Volume Controllers

This type of instrument maintains the flow of gas at the desired rate by automatically controlling the predetermined value of the differential. The maximum rate can be changed by changing the value of the differential by means of a direct set arm located on the instrument. The flow is automatically maintained at a constant rate. The instrument is extremely sensitive and responds quickly to any change in the rate of flow. The movement of the differential pen arm is positive in action and promptly operates the valve of the control block which

[1] Superintendent of Gas Department, Southern Carbon Company.



Pressure control valve at Alto, La., meter station.

changes the pressure on the diaphragm motor lever, which is attached to the regulator, thereby accurately controlling the rate of flow by varying the opening in the regulator.

Pressure Controllers

The air- or gas-operated pressure controllers for either back pressure or reducing pressure applications of the supersensitive remote control type is used. The uniform transmission of control factor from the control pressure is carried out by a control gas valve. This makes it possible to obtain throttling action on the diaphragm control valve on any pressure application. It is adapted for use with any lever or diaphragm operated valve, giving equally satisfactory results when local conditions are considered.

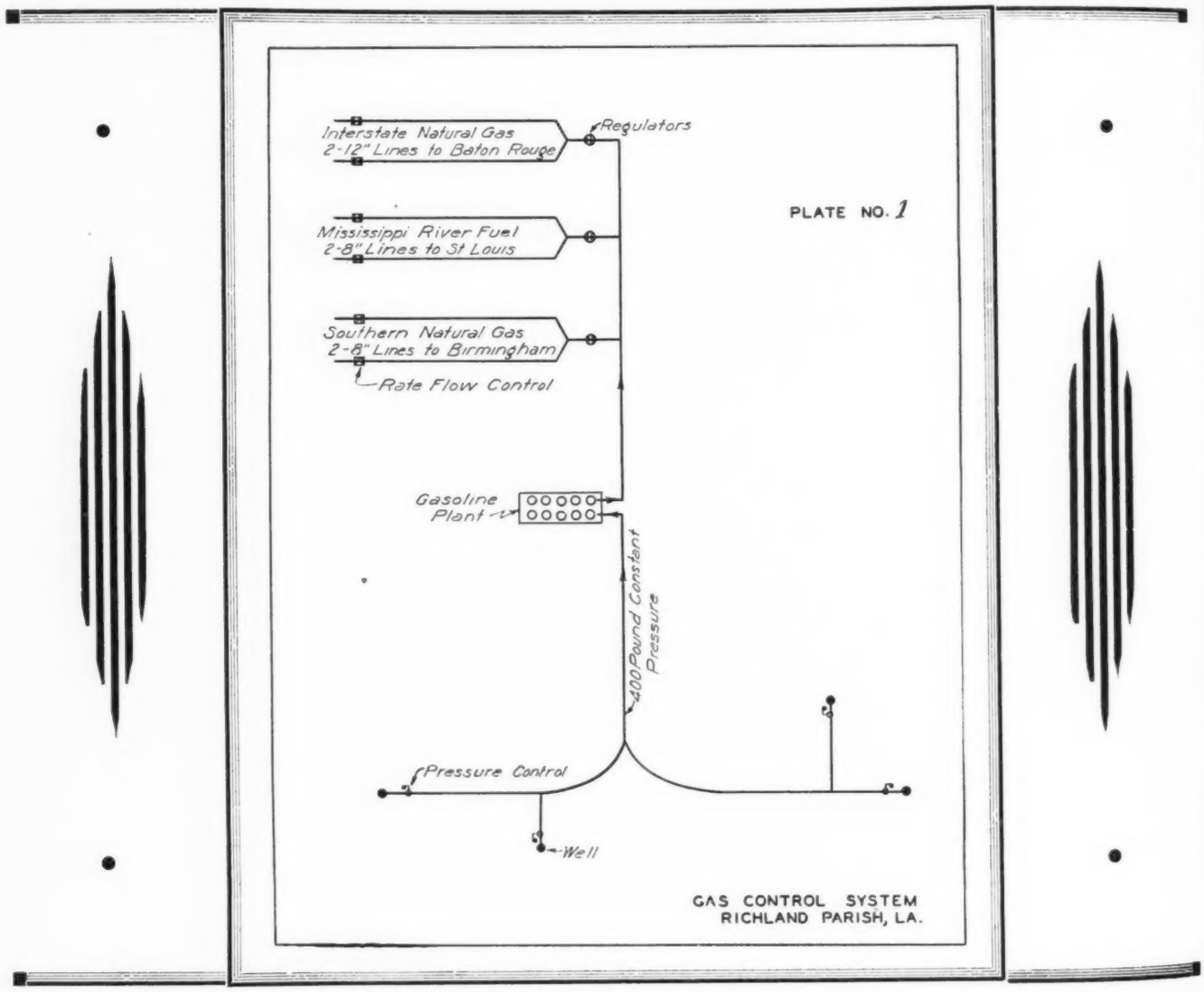
V. F. Sackett.

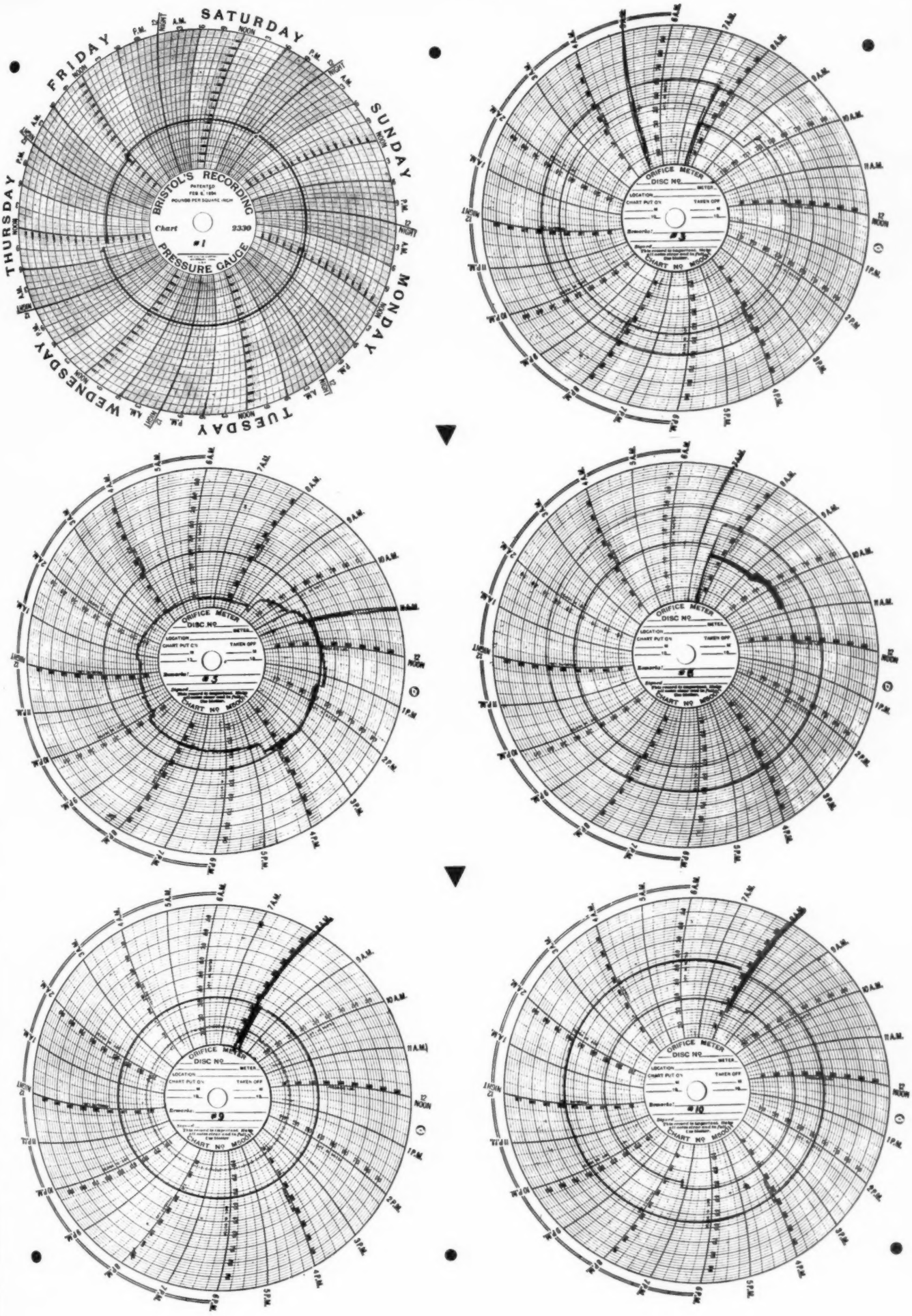
A recent development in pressure control instruments is the direct set recording or indicating pressure regulator which can be adjusted to suit the sensitivity required of each application. One of the salient features is that the operator can immediately adjust the instrument for any desired pressure by simply setting the direct set pointer to the desired pressure. The application of the pressure controllers is unlimited, they requiring very little attention, yet giving uniform pressure at all times. All of the pressure control instruments used in our system are pilot-operated. We have found that it is not necessary to change the relative position of the regulator to orifice flange to use either a pressure or rate volume controller, as we have in operation controllers where the distance between the meter and the regulator varies from 100 to 6,000 feet.

Our company handles approximately 150,000,000 cubic feet of gas per day during the summer season, all gas being regulated by automatic controllers. However, during the winter season the quantity of gas we handle is greatly increased. The field system includes sixty miles of four-inch gathering line, fifty-five miles of six-inch line, seventy-five miles of eight-inch line and ten miles of twelve-inch line. The quantity of gas taken from a well depends upon the size of the well, the rock pressure and the acreage in which it is located. The pressure controllers located at the wells are equipped with adjustment blocks which are set to prevent the overproduction of any well.

Richland Parish

The gas system in Richland Parish is shown by plate No. 1. The working pressure of approximately 650 pounds (chart No. 1) is reduced to 410 pounds (chart No. 2) which is the line pressure carried on our system at this time, the gas passing through the gasoline plant at this constant pressure, as shown by the chart. From this plant the gas goes to the Alto meter stations, shown in the accompanying

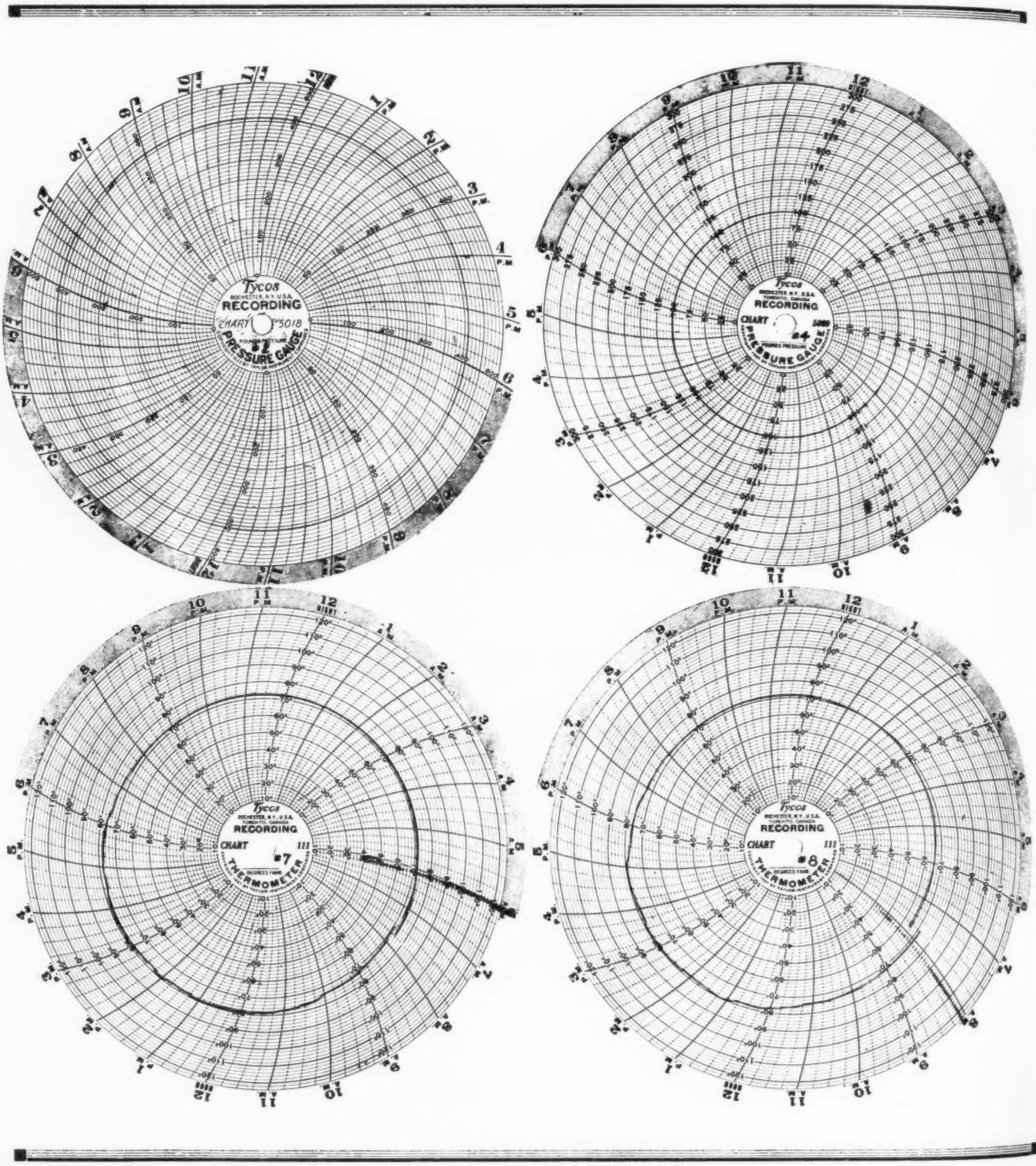



SATURDAY
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
BRISTOL'S RECORDING
PRESSURE GAUGE
Chart
2330
#1
ORIFICE METER
DISC Nº
#3
#5
#6
#9
#10
CHART Nº

photograph, where it is distributed to the three pipe lines shown. The pressure regulators and the rate volume controllers are shown in this sketch, accompanied by photographs of the pressure rate volume controllers and motor levers which operate the main regulators. With the present system in use it is not necessary to send men into the field to change the quantity of gas desired, as the rate volume controllers can be changed at the main station. As the pressure increases or decreases on the high side of the main regulator the pressure controllers at the wells open or close the regulators in accordance with the demand, maintaining a uniform pressure in the gathering system. At this particular station our rate of flow can be varied at any time from 10 to 50 million cubic feet per day through our automatic control system.

Ouachita and Morehouse Parish

The gas system and control instruments are shown in plate No. 2. With the use of recording pressure controllers the gas is regulated in a twelve-inch line supplying small towns, covering a distance of one hundred miles and ending at Alexandria, supplying this city with gas. The gas to the city of Monroe, supplied by us, is also controlled by a recording pressure controller. A constant pressure of 200 pounds is maintained at the Fairbanks regulating station, regardless of the variation in volume, as shown by



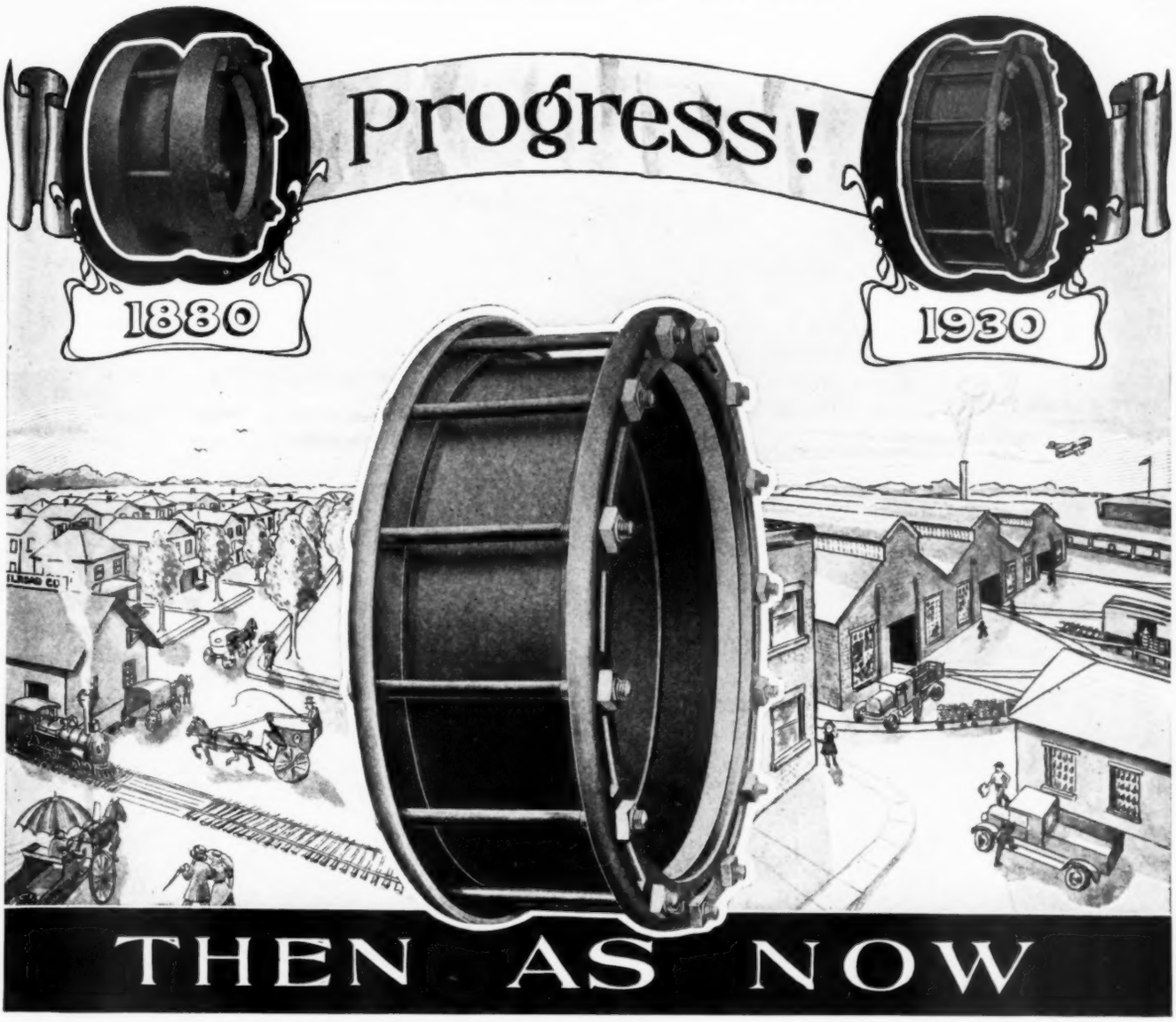


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chart No. 5. The rate on this line varies from a minimum of two to a maximum of twelve million cubic feet, and when the load to Monroe drops off the back pressure regulator, shown in the diagram, opens up, the gas entering other lines, or wells are cut back with recording pressure controllers due to the increase in line pressure.

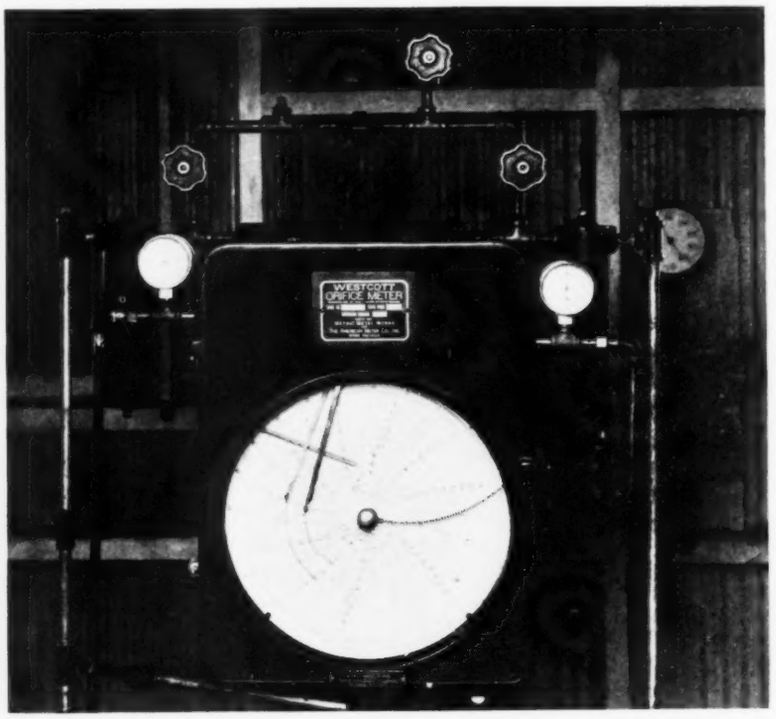
Charts

Chart No. 1 shows the working pressure on one of the wells.

Chart No. 2 shows the constant pressure of the line, stepped down from well pressure by means of a pressure control valve. This chart is taken from the line to the gasoline plant shown in plate No. 1.

Chart No. 3 shows the action of the rate flow control on the Interstate line to Baton Rouge (Plate No. 1).

Chart No. 4 shows a pressure control valve handling 252,000,000 cubic feet per month with constant pressure on line.



Rate-volume controller at Alto, La., meter station.

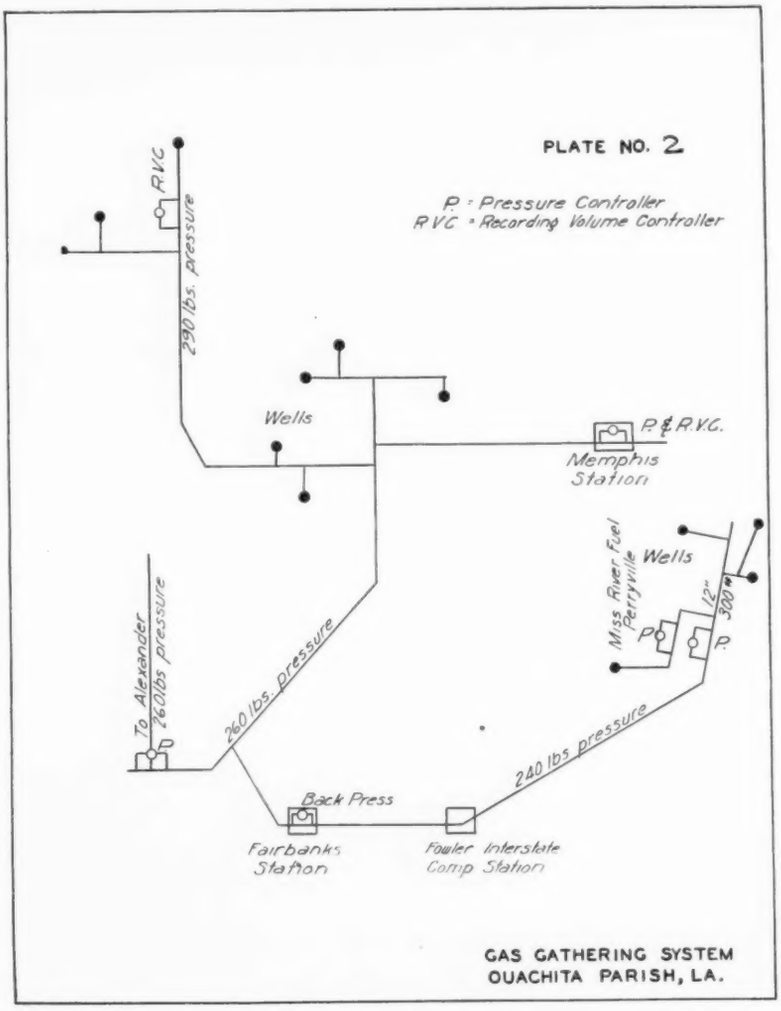


Chart No. 5 shows a record of a rate volume controller handling 550,000,000 cubic feet of gas per month.

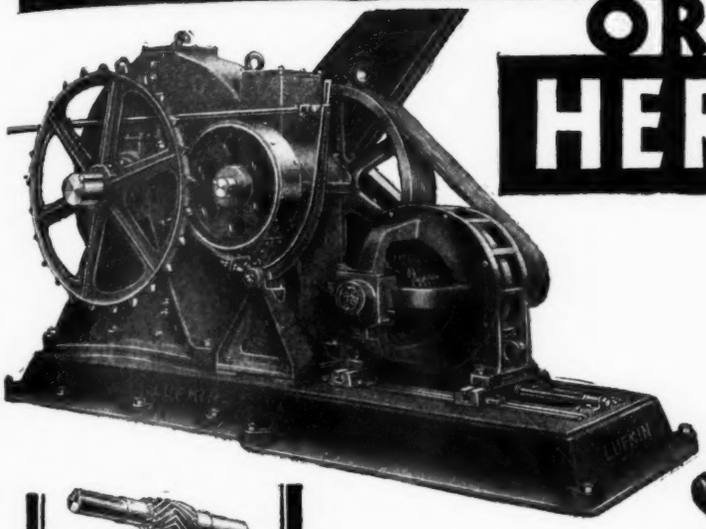
Chart No. 6 shows a rate volume controller at the Alto station maintaining a constant differential regardless of line pressure fluctuation. If the line pressure is raised the volume of gas is not cut down. This instrument controls 900,000,000 cubic feet of gas per month.

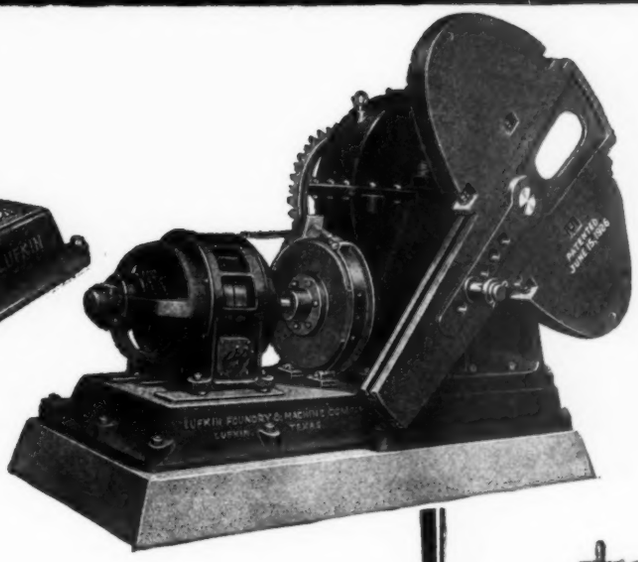
Charts Nos. 7 and 8 are from recording temperature instruments used in calculating the volume of gas.

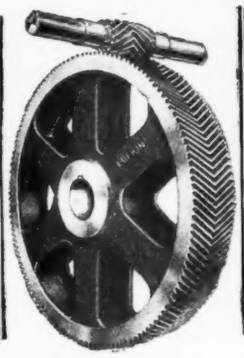
Chart No. 9 is from a rate volume controller on the line to Birmingham (Plate No. 1). It controls 100,000,000 cubic feet of gas per month.

Chart No. 10 is from a rate volume controller on the line to St. Louis. It controls 280,000,000 cubic feet of gas per month.

WORM GEAR OR HERRINGBONE?







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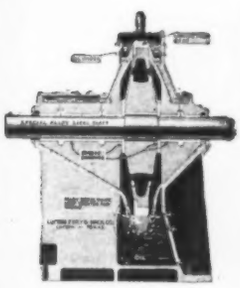

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Contractors Find That

Hobbs Offers Many Difficult Problems

By R. D. ROBEY, JR., *Engineer, Olson Drilling Co.*

THE Hobbs pool in Lea County, New Mexico, will probably be the field of outstanding drilling activity for several months. This pool has many peculiar features which present real problems to the operator and contractor.

Structurally, it is located on a limestone high with a surface of caliche, about thirty feet thick over a greater part of its area. Below the caliche are beds of broken lime and sand which extend from 130 to 165 feet below the surface. Red beds with some water-bearing sands are found between the broken lime and anhydrite which is generally encountered at about 1,500 feet throughout the pool. The anhydrite is mixed with salt and extends to a depth of approximately 2,600 feet.

Within this salt and anhydrite are two horizons which contain air under considerable pressure but with little volume, one, between 2,100 and 2,200 feet; the other, between 2,400 and 2,500 feet. This many times "blows" the drilling mud and occasionally causes it to rise above the rotary table.

Main Street of Hobbs, New Mexico.

The formation between 2,500 and 4,200 feet is mostly limestone with several sand breaks which contain gas under considerable pressure. The first gas is encountered at about 2,800 feet and is widespread over the pool. It has about 3,000,000 cubic feet volume with a rock pressure of 1,100 to 1,500 pounds per square inch, but this varies at different localities, being stronger in the north part of the pool. The second gas is found at 3,100 to 3,200 feet, it also has little volume but considerable rock pressure. It is widespread and has greater pressure in the northern part of the district. This horizon has been tested for oil in the northern part and in one well produced about 300 barrels per day.

The third gas stratum is found at 3,700 feet and this only in the north and central parts of the pool. This is a broken sand stratum and produces a gas which has an extremely high rock pressure, having shown pressures of 2,200 pounds which are much higher than would normally be expected at this depth. This stratum has been found to be water-bearing in one well.

The producing horizon is a limestone which is dolomitic in character and probably has numerous secondary crevices of considerable size. This is evidenced by the occasional sudden dropping of the bit from 6 inches to 2 feet. Porosity is undoubtedly a most important factor in this pool as is shown also by the variation in initial production of wells identically located with regard to structure. As an example of this we find in the southern part of the field a 5,000-barrel well offset on the north and south by wells of approximately 500 barrels initial production and on the west by a well with 6,800 barrels initial production. In the north portion the wells vary in size of initial production from 8,000 barrels to 28,000 barrels per day.

The variations in gas pressures and initial productions of wells in the area have caused many problems and much experimenting regarding methods of control, drilling and setting of casing. The south portion of the pool offers fewer problems and difficulties than the north portion. It has been the practice of some to spud the wells in the south part and drill them about 200 feet with cable tools and change to rotary after the surface casing is set. The rotary is used to about 1,600 feet and then cable tools are used to complete the well. This practice has its advantages in that it is more economical than using the rotary all the way down. It is impractical to use cable tools from 200 to 1,600 feet, due to the water-bearing sands and red beds. Cable tools are often blown up in the hole and stuck when drilling through the 2,800-foot and the 3,100-foot gas strata.

Drilling in the north part of the sector is done entirely by rotary. Considerable difficulty is had in preventing blow-outs caused by the high gas pressures. It is now the practice to set three strings of casing in the north part of the pool.

Even where utmost care is taken there are occasional blow-outs with the resulting loss of much mud. The mud used is nearly all transported commercial clay.

When a mud of 14 pounds weight is used in drilling in the gas strata it often returns to the pit weighing less than 8 pounds. This is due to the gas becoming mixed through the mud and held by the large amount of solid matter present. To avoid this condition there is much use made of minerals and clays of higher specific gravity, thus reducing the volume of solid matter required to give a mud of 14 pounds weight. However, where such heavy preparations are used in considerable quantity there is a tendency for the solid material to settle when the mud is not continuously agitated. At present commercial clay which has the ability through chemical reaction to hold the heavier constituents of the mud in suspension is being used to some extent. A mud which is the result of a mixture of such commercial clays and preparations is fairly satisfactory; however, even this is, in many cases, incapable of preventing blow-outs. It is also readily cut by the salt, water, and gas. There is still much experimenting being done in order to find effective methods of controlling the high gas pressures encountered.

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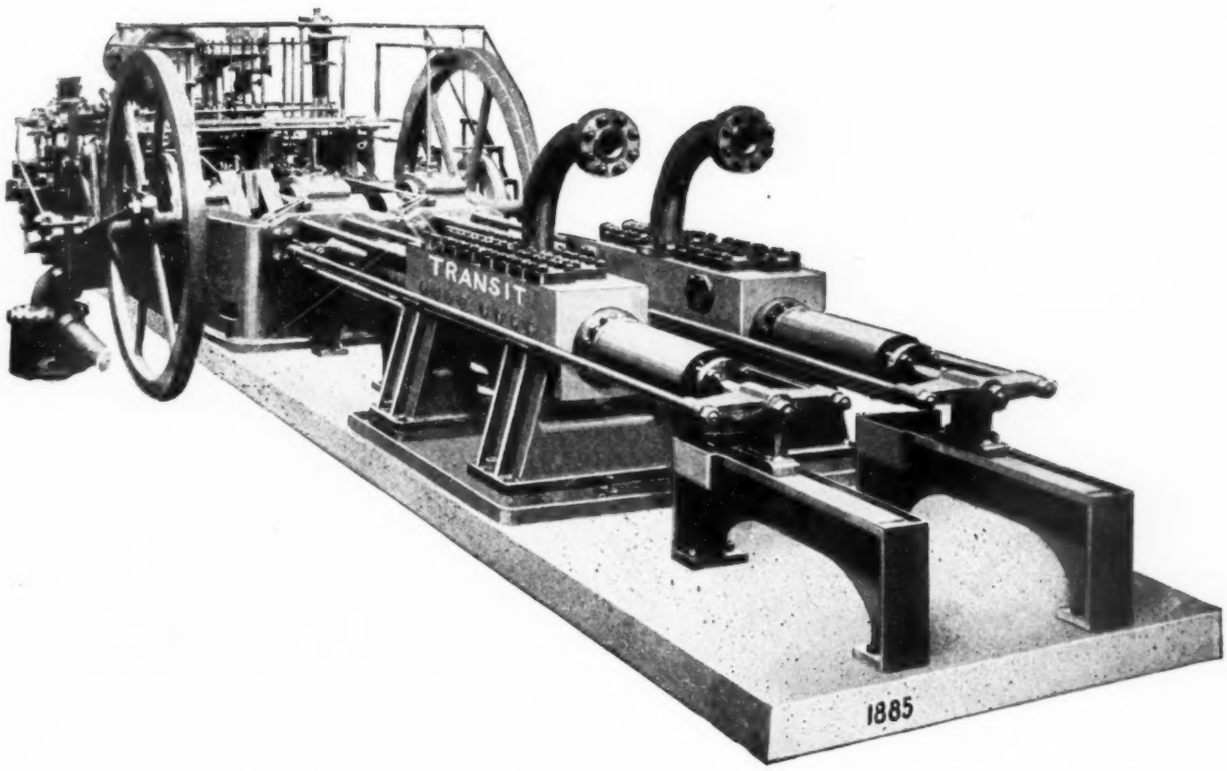

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Flexibility of Modern Equipment Helps in

Speeding Construction of Ajax Line

By J. H. DAMERON

1—Eleven-hundred-pound river clamp. 2—Twin lines crossing Arkansas River. 3—Hand-operated pipe-wrapping machine. 4—Making deep cuts for lines across Verdigris River.

THE wide range of flexibility of modern pipe line construction equipment to various jobs is one of the factors speeding completion by the first of the year of the Ajax Pipe Line Co. project, a 500-mile double, 10-inch, gas-welded oil carrier. When completed the line will be the equivalent to an 800-mile 10-inch line. It originates at a point near Glenn Pool, Okla., and terminates at Wood River, Ill.

The new transporting subsidiary of the Standard Oil Co. (N. J.) will have a daily capacity of 65,000 barrels and it is in a position to accept deliveries from affiliated companies in the Mid-Continent territory.

Starting with the right-of-way clearing and going to back filling, the Oklahoma Contracting Co., builders of the line for the Ajax, have purchased all new equipment for the construction work. Virtually all of the work is being done with machinery and the crawler type of tractors with booms and winches are being adapted for a wide range of uses.

A great portion of the line goes through broken and rough country and a considerable portion of the right-of-way through the hills is in rock which it is necessary to blast. Some of the hills are exceptionally steep, making it advisable to weld sections of the line on top and ease them down the slopes with the aid of tractors. There are five stream crossings going into the classification of major jobs, and these, along with the bottom land crossings, are being pushed to completion in advance of bad fall weather.

Working ahead of the ditching machines is a right-of-way machine with its skimmer-shovel cutting a path through underbrush and ripping out other obstacles which would slow up ditching. This machine is sometimes used to cut deep trenches for the approach to river crossings and may be used for removing rock from the ditch.

In several sections there is considerable surface rock which has to be blasted out. In such areas a special crew digs the trench. This crew is comprised of air drill operators, shooters and a gang of day laborers. The shot hole drillers with portable air compressors, work a safe distance ahead of the shooters and the latter work in approximately the center of the gang. After the rock has been shattered with dynamite it is removed by the gang following the shooters.

In country where the digging is not too difficult the ditching machines will cut between 5,000 and 7,000 feet of trench daily. A ditch 30 inches deep and 22 inches wide is being made. These machines cut the trench for No. 1 line and spill the dirt outward. When that line is lowered and the back fill made the ditcher for No. 2 line comes along and spills its dirt on top of the back fill for No. 1 line. The two lines are approximately four feet six inches apart.

Pipe is strung on the outside of the stakes for the two lines and the right-of-way clearing is wide enough to permit freedom of movement for the crews to work. A special truck equipped with a gin pole is used to unload the pipe at various shipping points. Most of it is unloaded to the trucks and trailers and that which is not is unloaded on the ground and later loaded on the trucks by the gin-pole truck. Two and one-half ton trucks are used to string the pipe and on an average each truck hauls five joints of the random length pipe.

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fire line and move forward at about the same time. This gang is comprised of a foreman, stabber, tractor driver and seven men.

Sections of the line are tacked in five-joint sections which require eight roll welds by the firing line. After the tacking gang completes a section a starting point on the top center is indicated by a chalk mark. When the welders in the firing line move to that section all start at identical points on the pipe and complete the welds at approximately the same time. This eliminates considerable lost motion and leads to more uniform welds.

5—Firing line welder working under umbrella. 6—Welding nine-joint sections. 7—Generator and equipment.

The main gang on the firing line works from 10 generators and four welders work from each generator wagon. With two settings of the generator the welders complete a nine-joint section, and are ready to move ahead to another section. A straw boss is assigned to every four generators and two "spell off" welders work with the same number of generators for relief duty.

Approximately 30 minutes is required to make a roll weld on the 40.483 pound, three-eighths-inch wall thickness line pipe. Specifications demand that the welds be from one to one and one-eighth inches wide and three-sixteenths of an inch in height. One-quarter-inch, No. 7, drawn iron rod is used to weld the pipe. Working with each generator is a helper and generator man. After the welders start on a section the two helpers care for the rolling of the pipe with chain tongs.

Approximately five rods or in the neighborhood of two pounds of welding material is required to make a roll weld. On an average each welder is turning in around 13 welds per nine-hour day, and considering the rugged country being worked which cuts into moving time the average is considered good.

Only occasionally are welds destroyed for testing. The contracting company has a crew of inspectors in its foremen and field men and in addition the Ajax Pipe Line Co. has inspectors on the job. Each weld must have the approval of the group of inspectors before it is passed.

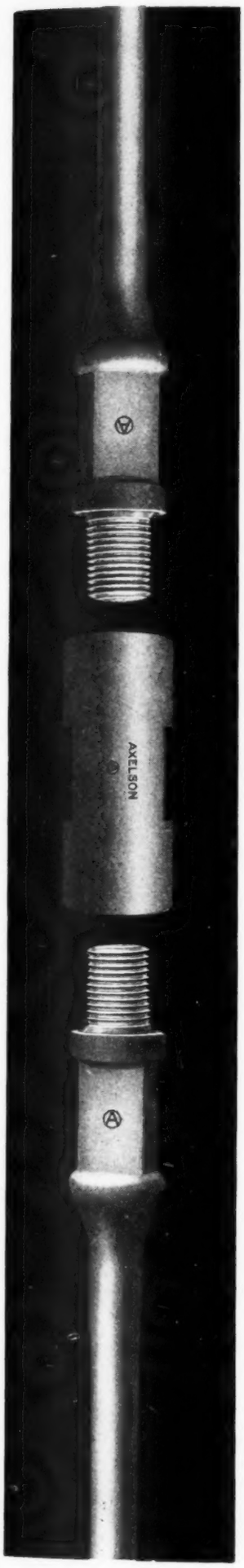
The improved model generators are mounted on wagons with wide steel tires and drawn by a team. On the rear of the wagon is a frame rack for eight bottles, four of which are in use and the remaining four in reserve. In addition the wagons carry 200 pounds of carbide, spare parts for equipment, and welding rods. A truck is assigned to the main gang to transport bottles and other equipment and material. A water wagon works with the main gang making periodical trips to each generator.

Maintenance of the welding equipment is cared for by a repair man who devotes his entire time to that job. He carries tools in the field to repair most any kind of trouble and consequently the down time for generators is lowered to a minimum as a result of not having to keep a unit down for hours while spare parts are being brought from a distant point. This man also superintends the periodical cleaning of the equipment and repairs the gauges used on the welding apparatus.

In the level country the bell hole welders work separately and considerable distance behind the firing line. In more broken country the bell hole welders work along with the bending gang, which employs the tractors to a wide range of work.

All types of bends are made with the tractors and with the material being handled this work is relatively simple to accomplish with the machines. The over-bends are made by holding down the two ends of a section of pipe and raising it at the point of bending with the tractor's boom and front end winch. Sags are made holding down the middle of the section and raising the two ends and side bends are accomplished by holding the two ends of the pipe while the tractor pulls from the side.

An example of the flexibility of this equipment is gained from the experience of the crew that had one of its tractors break down when everything was in readiness for a



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sag. The remaining tractor was maneuvered to a position lengthwise over the ditch. Skids were piled on top of one another over the ditch and the stiff leg on the boom placed on the skids. This was anchored by two workmen who held bars in the skids and jam against the base of the stiff leg.

The tractor winch was used to slowly pull upward on the pipe until it had been bended sufficiently for it to hug the contour of the trench. A snatch chain was hooked to the pipe and after the section was lined up the pipe was held in place with a clamp and the snatch line until the tack weld was made by the bell hole welder.

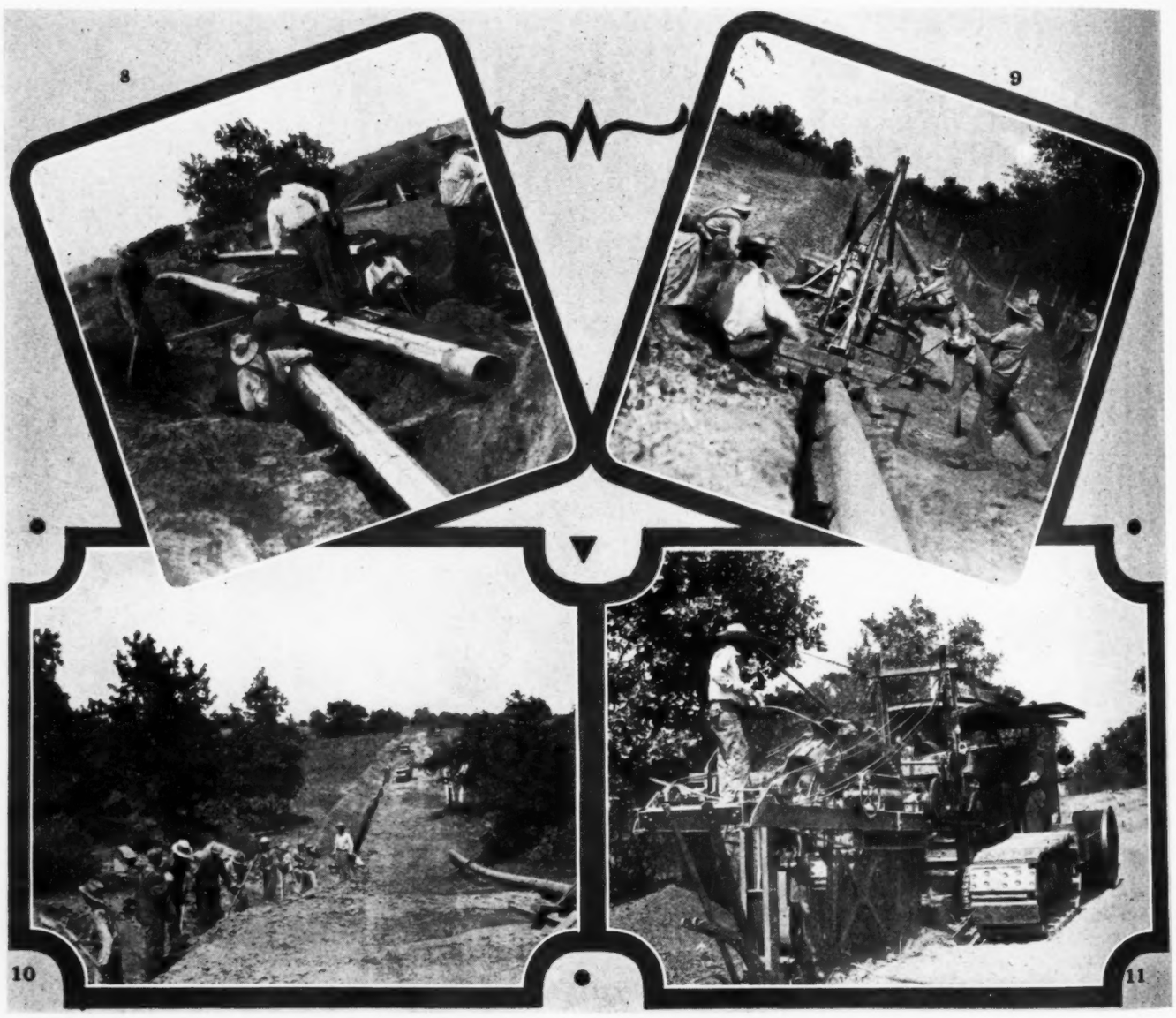
Where highway crossings are made by digging a trench instead of boring underneath the tractors are used to make the back fill and then roll the fill level with the road by running back and forth over the fill. In handling the pipe before it is painted the tractors raise and lower it with the aid of either chains or hooks. After the pipe has been coated a wide sling is used to prevent the coating from being broken.

The entire line is being coated with a cold application of priming paint, a hot coating and then wrapped with a saturated felt. The priming coat is applied by a crew using slings and brushes to spread it. This crew works approximately half a mile ahead of the crew applying the hot application, and can cover a mile of pipe daily.

The hot application is heated to a temperature near 300 degrees and then poured on the pipe by hand and spread by workmen using canvas or rag slings. This coating has an average thickness of around one-eighth of an inch. It is heated in the field with the newer models of portable pots. The crew can cover about one mile of pipe daily.

A hand-operated pipe-wrapping machine is used to wrap the saturated felt covering over the hot application. It consists of a steel frame which is split and hinged so the machine is easily slipped around the pipe. A holder is attached to the frame to carry the roll of felt. The frame is supported on the pipe itself over the felt by means of rubber rollers set at an angle so that as the machine is rotated the felt is wound spirally on the pipe.

The rubber rollers have the added advantage of ironing the felt in making a tight and smooth job. Any reasonable width of felt may be used and any lap may be obtained by adjusting the angle of the rollers. A brake is applied to the axis of the felt rolls so that any tightness of wrap may be obtained. The machine easily rides over bends, sags or side bends. It may be used immediately behind the hot application to bond the felt to the coating or after the hot coating has cooled.



8—Preparing to open valve to remove line scraper from river crossing. 9—Making sag with single tractor. 10—Cutting trench in rocky country. 11—Modern ditcher cutting 30-inch trench.

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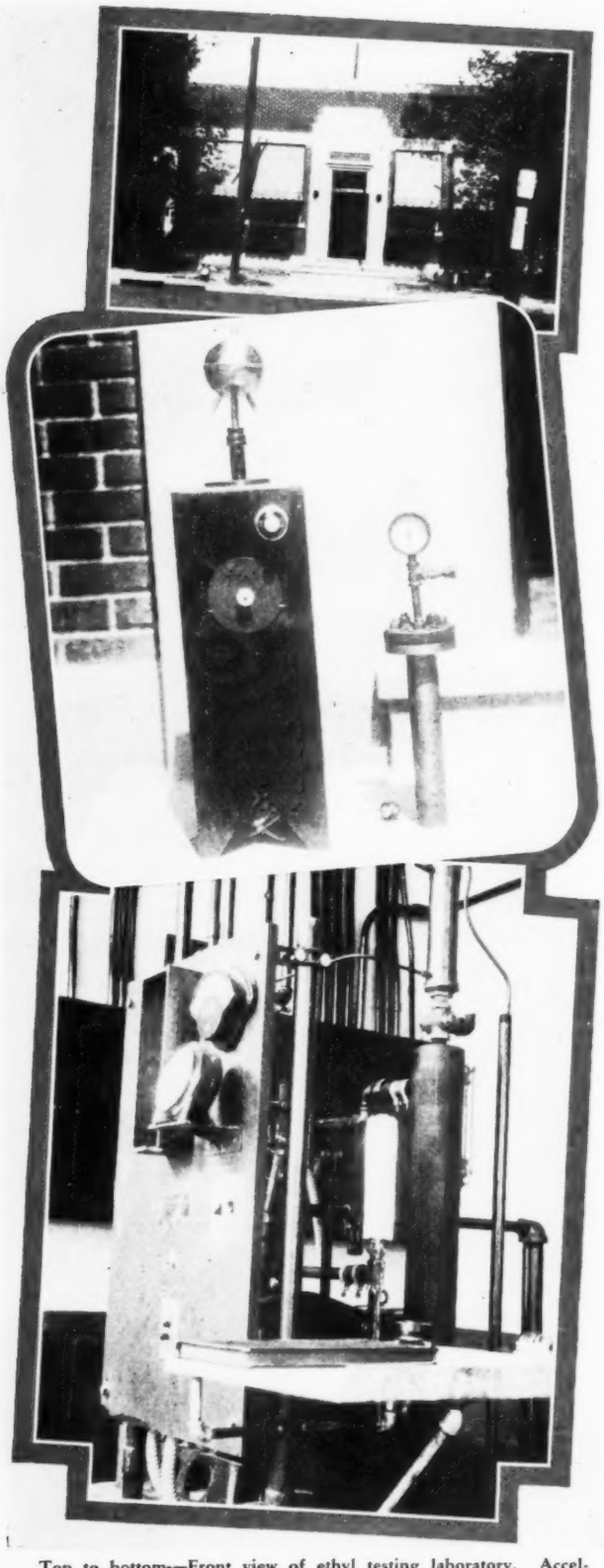
New Laboratory for

Testing Properties of Ethyl Gasoline

By F. R. STALEY



Top to bottom—Front view of ethyl testing laboratory. Accelerated gum testing apparatus. View of Series 30 anti-knock machine.

THE new testing laboratory of the Ethyl Gasoline Corporation located in Tulsa, started to function July 7th under the direction of H. L. McIntire. The laboratory also serves as headquarters for J. G. Martin, division manager of the company, who keeps in close contact with the work. The Southwestern Division comprises the states of Oklahoma, Texas, Arkansas and Louisiana, and is served by two laboratories, at Tulsa and New Orleans. Co-operating with the laboratories, the district manager has under his direction five field engineers, who collect samples, supervise blending, and render service to customers.

J. G. Martin, Dist. Mgr., Ethyl Gasoline Corp.

During the past year there has been an enormous increase in the number of refiners blending Ethyl gasoline. In less than two years the number in this division has increased from 10 to more than 30. There are 44 blending points now operated in the Southwestern division.

In addition to the offices and supply room, the new building contains four laboratories, as follows: (1) the chemical analysis room, where the lead content of the samples is determined, (2) gum, sulphur and distillation room, (3) sample receiving room for marking and recording samples and routing them in the laboratory so that all tests on a given sample can be carried on simultaneously, and (4) the engine testing room, which at present contains two "Series 30" knock-testing machines. This apparatus was described by Earl Bartholomew in The Petroleum Engineer, March, 1930. A synchronous motor is used in the unit, which maintains a constant speed of 600 r. p. m., controlled within a half revolution. A bouncing pin is used in connection with a knock meter for detecting detonation. This replaces the electrolytic cell formerly used. The principle of the knock meter is that an electric circuit is closed by the bouncing pin when the engine knocks, and the current in the circuit is shown by the indicating needle of a millivoltmeter. The unknown samples are checked against the laboratory's standard, and the quantity of fluid required to bring its anti-knock value up to the standard is determined and wired immediately to the refiner.

The gasoline samples received at the laboratory are designated as A samples and B samples. The A samples are those received from the refiner. They include the untreated and the Ethyl treated gasoline. The B samples are those gathered by the field engineers of the company from the service station pumps and bulk plants.

The A samples, untreated, are tested to determine if the product is suitable for blending with fluid and also the knock rating is determined. The following tests are run on the A samples: gum, sulphur, distillation, corrosion, and knock rating.

On the B samples the same tests are made, and a lead analysis is run also for the purpose of determining possible dilution.

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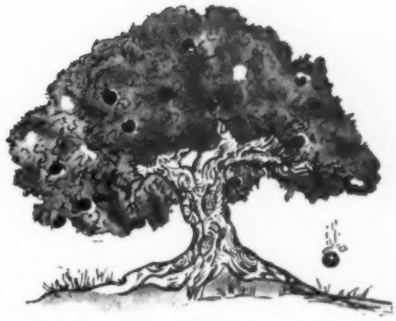

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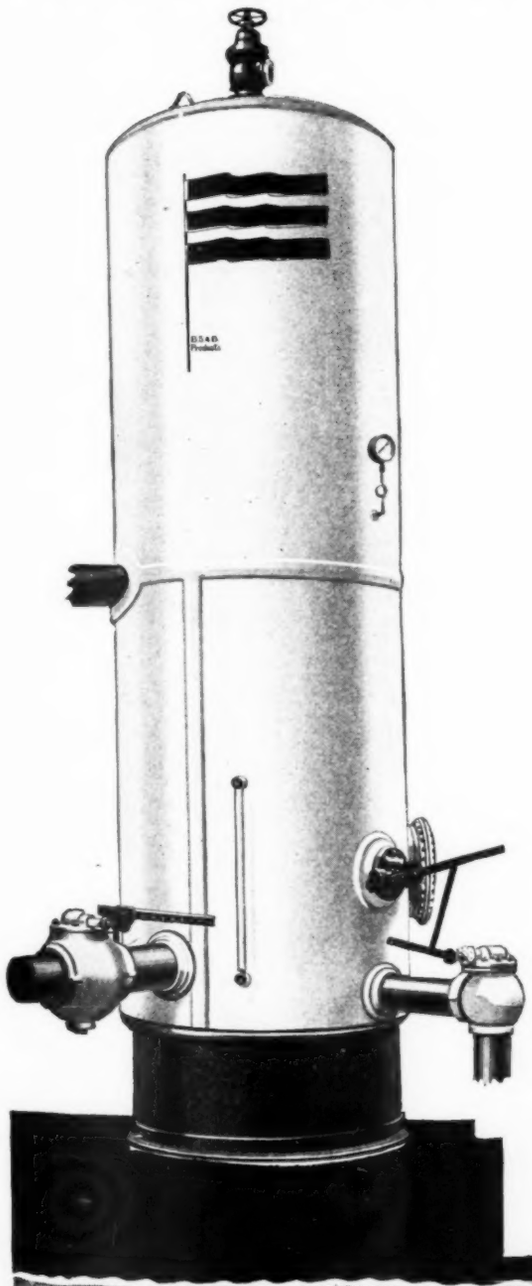

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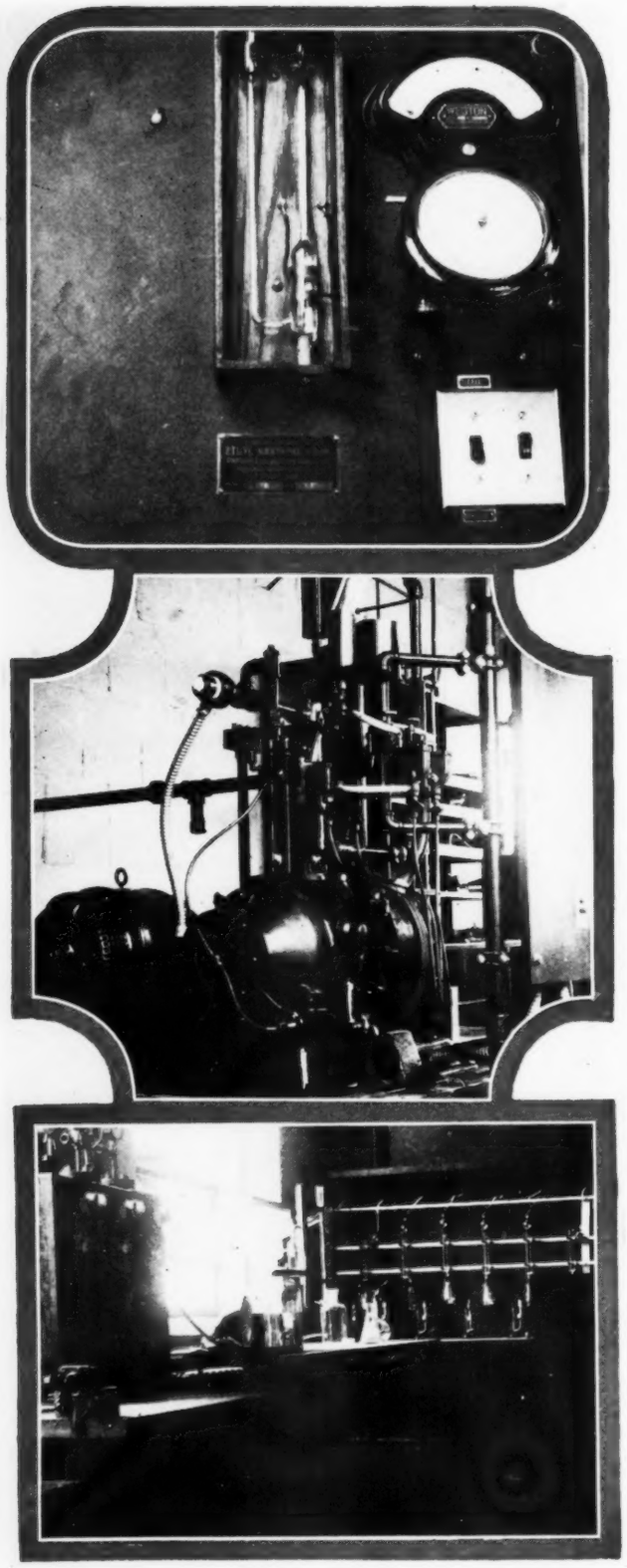

Top to bottom—Electrolytic cell and knock meter. Another view of Series 30 anti-knock apparatus. Sulphur analysis equipment.

In determining the quantity of fluid required for a given sample on the knock-testing engine, the sample is run against the Ethyl standard fuel. Fluid is added to the unknown gasoline until its anti-knock value equals that of the standard. The number of cubic centimeters of lead tetraethyl required is then wired to the refiner.

The sulphur determinations are run in a sulphur lamp, which is a modification of the A. S. T. M. method.* The fuel burned is determined volumetrically and no weighing is required. The method has been repeatedly checked, found accurate, and saves considerable time.

The company has discontinued the use of the copper dish method, as it is considered by them inaccurate and unsatisfactory. On all A samples an accelerated gum test is used. The apparatus used is shown in one of the accompanying illustrations. On the B samples the dissolved gum is determined by evaporation in a porcelain dish in a current of air, since it is desirable to determine the actual gum content of those samples rather than potential gums, as is the case on the A samples.

The accelerated gum test is a modification of that described by Hunn, Blackwood and Fisher (S. A. E. Journal, Vol. XXVI, p. 31 [1930]). It consists in heating a sample of gasoline under 100 pounds oxygen pressure at 212 degrees Fahrenheit for a period of four hours, pressure readings being taken every 15 minutes in order to make a pressure-time curve. At the end of the four-hour period the gum content is determined by evaporation in a porcelain dish in a current of air.

In interpreting the results of the test as much attention is paid to the "period of induction" as to the amount of gum. The magnitude of the latter, e. g., low, below 100 mg., or high, 100 to 1,000 mg., is of interest, but does not appear to be such a direct measure of stability as the induction period, that is, the period of heating elapsing before the bomb pressure begins to drop steadily. A gasoline which shows no pressure drop in four hours is regarded as quite stable. A gasoline which shows a drop in three to three and a half hours or less is regarded as less stable, though the exact quantitative significance which should be attached to these results is at present far from certain. As things are, results on accelerated gum must be subjected to quite careful analysis before conclusions are drawn, although it is expected that careful observation of the storage behavior of various gasolines will shortly give more accurate means of interpreting the accelerated test.

Gasolines are analyzed for lead by the method described by Edgar and Calingaert (Industrial and Engineering Chemistry, Analytical Ed., Vol. 1, p. 221, 1929). It consists essentially in precipitating the lead by the addition of bromine, filtering it off, dissolving it in nitric acid, and estimating it volumetrically.

The work of the Tulsa Laboratory is typical of that carried out in the five testing laboratories operated by the Ethyl Gasoline Corporation, and located at Yonkers, N. Y., Detroit, Kansas City, Tulsa and New Orleans. The Yonkers laboratory is the control, developing and perfecting the test methods, specifying the equipment, and organizing the co-operative tests which are necessary to make sure that all of the laboratories obtain strictly comparable results. This elaborate testing and control system is designed to make certain the quality of Ethyl gasoline does not fall below the high standards set for it.

* G. Edgar and G. Calingaert, "Determination of Sulfur in Gasoline, Industrial and Engineering Chemistry," Analytical Ed., Vol. 2, p. 104 (1930).

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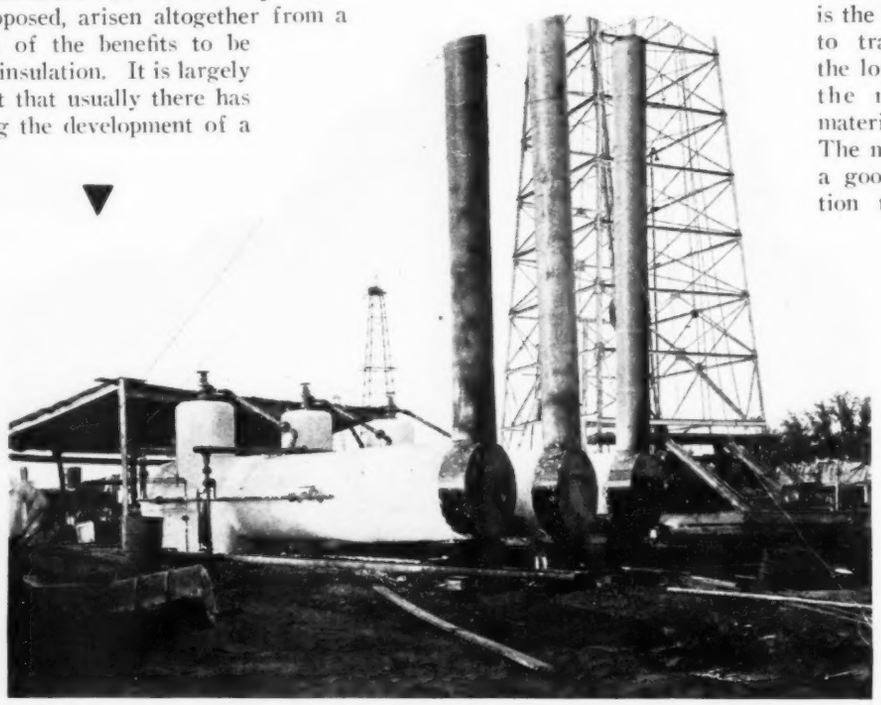
Insulation a Necessary Aid to Fuel Economy in Drilling Operations

By K. C. SCLATER

MORE attention than ever before is now focused on the application of insulation to oil field boilers, steam lines and steam-using equipment for drilling purposes. In light of the recent trend to greater boiler capacities and higher pressures for the field it would seem that this increased attention, rather than an augury of, really is a corollary to, the introduction of high pressure boilers for drilling purposes. The comparatively scant consideration given to the proper insulating of steam-generating and steam-using equipment in the oil fields in the past has not, as might be supposed, arisen altogether from a lack of appreciation of the benefits to be derived from proper insulation. It is largely the result of the fact that usually there has been available during the development of a field, an adequate supply of fuel in the form of natural gas for drilling. Instead of a valuable commodity to be husbanded, natural gas in a new field was more often looked upon as an incommodity hard to get rid of, hence, there was no incentive to consider the use of insulation in preventing steam losses and bettering fuel economy.



Insulation covering job on battery boilers at drilling well, Oklahoma City Field.

With deeper drilling, however, came the demand for heavier equipment. This meant greater steam consumption. Competitive conditions in the field made greater speed in drilling imperative. Delay meant loss. Boiler capacities and pressures were increased to cope with widely varying peak loads, an exigency that accompanies all modern deep drilling operations. Fuel—usually natural gas—in ever increasing quantities was consumed. Conditions have undergone a rapid change. Markets for natural gas as an industrial and domestic fuel have been expanded to the point that natural gas has become an indispensable and valuable commodity. In addition, large volumes of gas are being diverted to repressuring projects in ever-increasing quantity. It is only natural then that with such a change in conditions fuel economy in drilling should come in for a greater share of attention than has been accorded it heretofore.

Proper insulation of steam boilers, steam lines and steam-using equipment is a necessary aid in securing fuel economy. Some essentials concerning insulation and the properties of steam, therefore, might not be amiss at this time.

When the surface of a steam pipe is left bare there is considerable heat lost by convection to the atmosphere surrounding the pipe. A covering over the pipe that would retard the rate of heat transmission from the steam pipe to the atmosphere would be an insulator. The effectiveness of such an insulator will depend on the conductivity and the thickness of the material of which it is composed. Conductivity of an insulator is the property it possesses to transmit heat, hence, the lower the conductivity the more effective the material as an insulator. The main requirements of a good insulator in addition to low conductivity are, ease of application, heat resisting qualities, and mechanical strength sufficient to resist damage when adapted to field use.

Condensation in steam pipes and its contributory causes are better understood by a brief consideration of some of the properties of steam. Loss of heat in saturated steam results in condensation without a reduction in temperature. However, if steam is superheated a loss of heat is accompanied by a reduction in temperature, and no condensation occurs until the last degree of superheat is removed. For each pound of steam condensed at 100 pounds pressure 880 B. T. U.'s are lost; at 150 pounds pressure 857 B. T. U.'s are lost; and at 200 pounds pressure 838 B. T. U.'s are lost. A B. T. U. (British Thermal Unit) is the unit of heat and is the quantity of heat required to raise one pound of water one degree F.

Uninsulated surfaces are sources of heat losses. For example, assuming the temperature of the surrounding air to be 70 degrees F., the losses would be approximately as follows:

Steam Pressure (Gauge)	Loss per Sq. Ft. per 24 Hours	Cu. Ft. Gas Wasted per Sq. Ft. per 24 Hours
100	19,680 B. T. U.'s	20
150	23,040 "	23
200	25,900 "	26
250	28,420 "	28

Thus for every 20-ft. length of uninsulated 4-inch steam pipe, there would be an approximate daily loss of:

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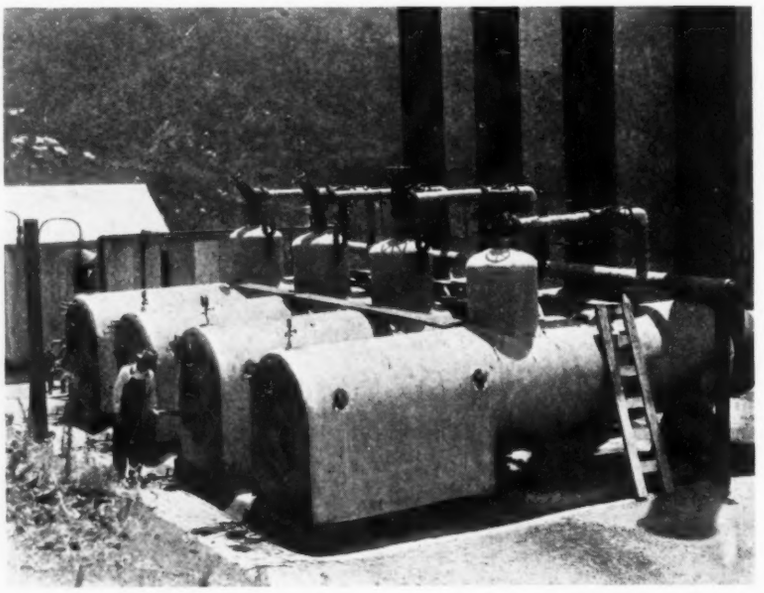
568,400 B. T. U.'s or 568 cu. ft. gas per 24 hours at 250 pounds pressure.

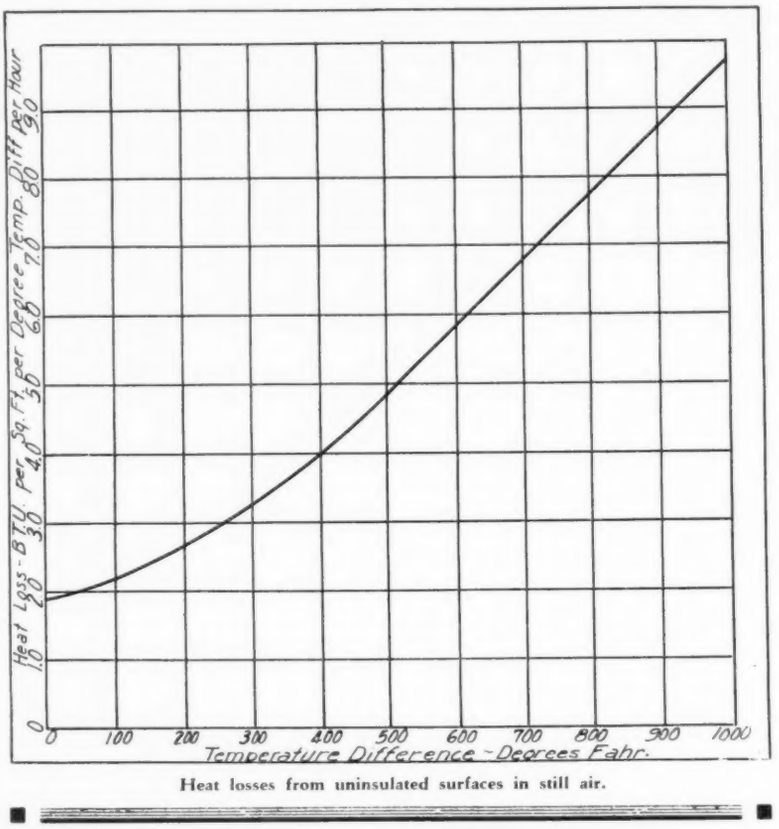
In the foregoing, the losses are assumed to occur in still air. However, the losses are greater if there is any wind blowing over the uninsulated surface. With a wind velocity of five miles an hour the losses from the bare pipe will be approximately doubled, and at 30 miles an hour the losses will be about four times the losses under still air conditions.



A battery of insulated boilers at a wildcat well in California.

Were these surfaces insulated with a good grade of asbestos insulation it is estimated that the losses would, in a 30-mile wind velocity, be increased over still air conditions only about 30 per cent for a 1-inch thickness, 20 per cent for a 2-inch thickness and 10 per cent for a 3-inch thickness of insulation.

The efficiency of an insulating material is the heat losses of the bare surface minus the heat losses of the insulated surface divided by the heat losses of the bare surface. This figure is expressed in per cent. Efficiencies provide a means of comparing the savings obtained by insulation with the uninsulated surface losses. A perfect (100 per cent) insulating material would be one that would eliminate all uninsulated surface losses. It is possible with a good insulating material of the right thickness and properly applied to obtain efficiencies well over 90 per cent.



Heat losses from uninsulated surfaces in still air.

Those who have given much study to insulating problems emphasize the importance of using an adequate thickness of insulation, especially for high temperatures, and point out that the larger sizes of pipe require a greater thickness of insulation than the smaller sizes. A smaller pipe will lose heat more rapidly per square foot than a larger pipe with the same thickness of insulation. The reason is the outside areas of the insulation and the pipe will be in proportion to their diameters, thus for a 2-inch pipe with a 2-inch thickness of insulation, the surface area of the insulation will be almost 300 per cent greater than the surface of the pipe, while for a 6-inch pipe with the same thickness of insulation the surface area of the insulation is only about 150 per cent greater than the surface of the pipe. In other words, for the same thicknesses of insulation the larger the pipe the smaller the ratio of outside surface area of insulation to the surface area of bare pipe. In computing the net savings obtained by insulation the cost of effecting the savings as well as the savings themselves should be taken into account.

Proper application of insulation is essential if the best results are to be obtained, and this work should be done by men skilled in this line. In applying asbestos insulation in the form of a paste, sometimes a small amount of Portland cement is admixed into the outer layers for strength, durability and protection from damage, but the underlying layers should on no account be treated with cement as it cuts down the efficiency of the insulation by filling the small air spaces. It is the small air spaces that the insulating material contains that renders it so effective as an insulator.

About two years ago some field tests were made with uninsulated boilers on two drilling wells in the Seminole field. One battery of three boilers was out in the open and another battery of three similar boilers was covered by a rough housing. It was found that the battery of boil-

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BRAUN LEADS IN PERFORMANCE

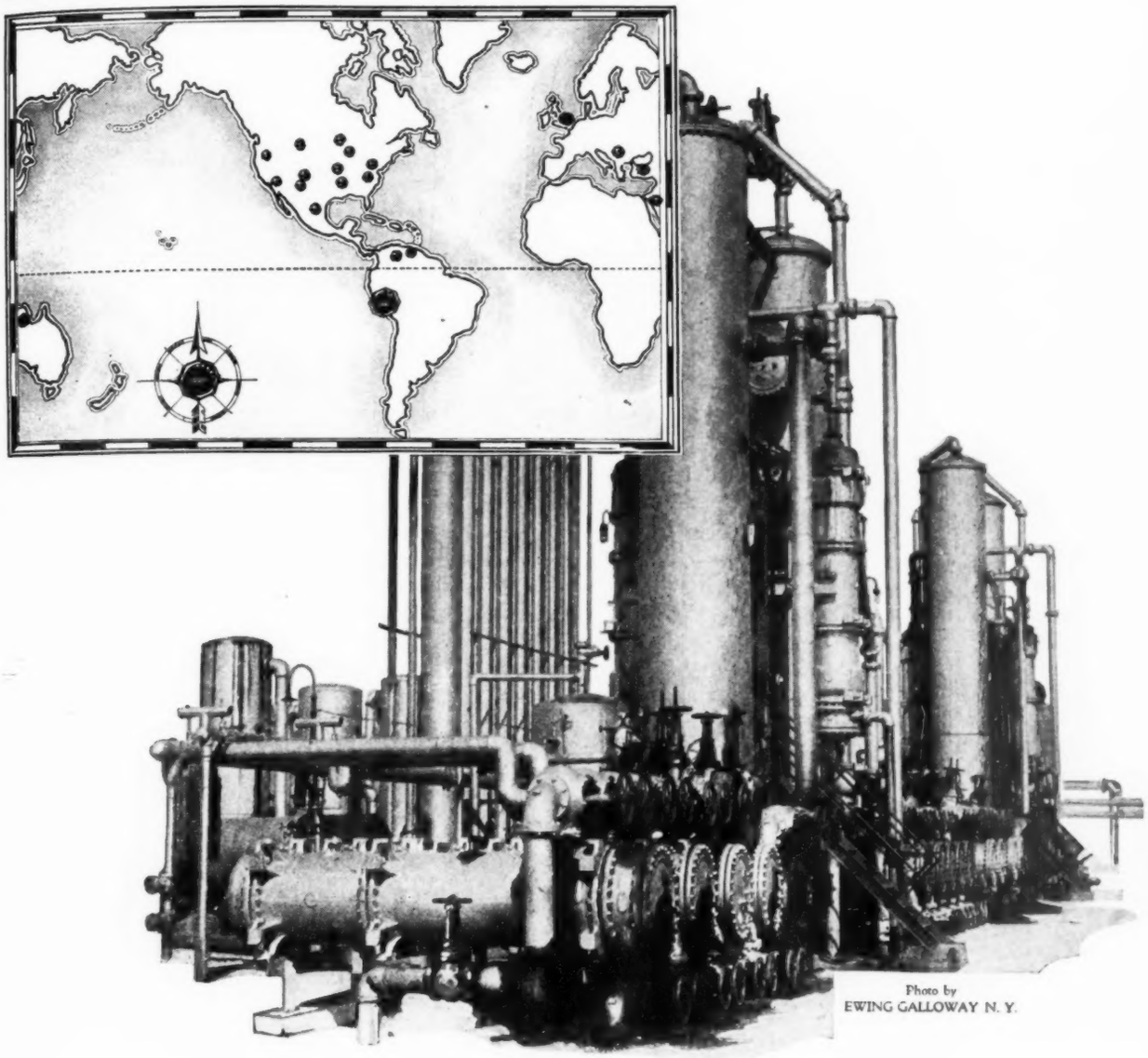

Photo by
EWING GALLOWAY N. Y.

IN PERU . . . this Braun absorption plant has been operating for four years . . . faithfully performing its allotted duty . . . yielding a profit to the owner. Where there is oil or gas . . . at the front door of civilization or at the industry's outposts far from bases of supply . . . Braun apparatus is chosen for the overwhelming superiority made possible by the efficiency, experience and stability of the Braun organization.

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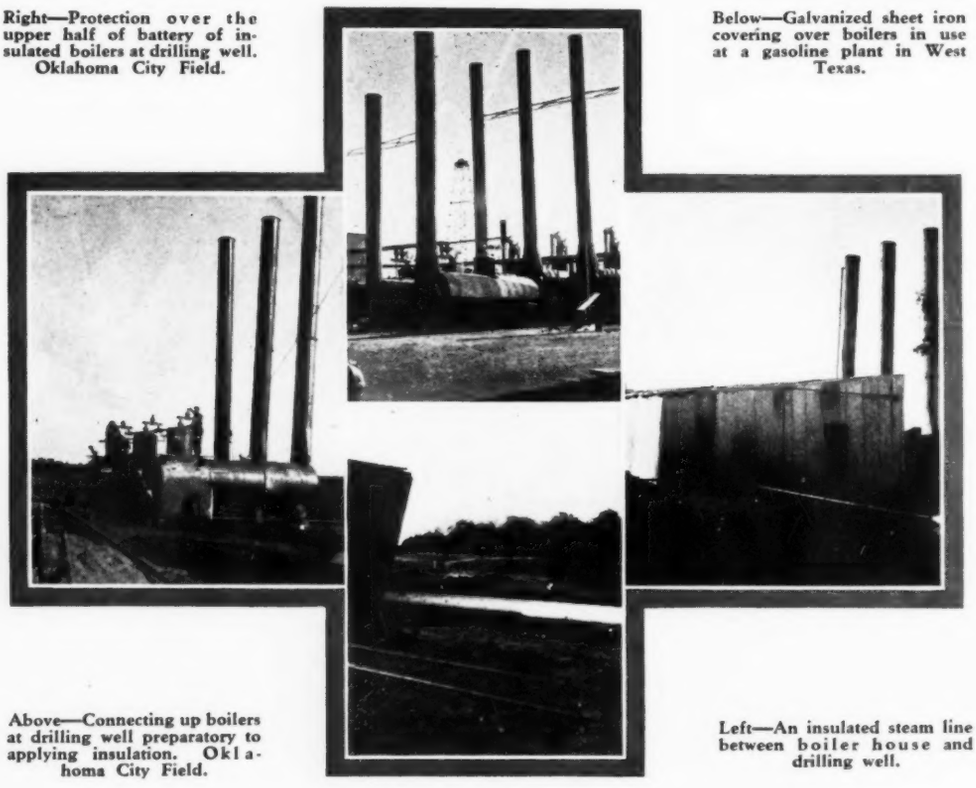
ers under cover consumed about 290,000 cu. ft. of gas per day, while the battery of boilers in the open consumed about 330,000 cu. ft. of gas per day. Drilling conditions and firing of boilers were almost similar. Also the gas volumes were carefully metered. A test of this kind, although it is by no means conclusive, does indicate the possibilities and opportunities for effecting fuel economies in the field by insulation.

Apart from the fuel economies there is an appreciable saving in the wear and tear on equipment. An uninsulated boiler out in the open is subject to sudden atmospheric changes in temperature. These are apt to set up strains by causing unequal expansion and contraction. Continual repetition of these expansions and contractions is detrimental to the boiler and is a contributing cause of leaks.

In the steam cylinders of prime movers and pumps the presence of steam condensate decreases the efficiency. Condensate in the cylinders robs the incoming live steam of some of its heat. If present in too great an amount it is liable to cause damage to the cylinder head. Shocks imparted to the other moving parts by excessive amounts of condensate in the steam cylinder can become a source of serious trouble. The advantages of dry steam are now recognized by those operating steam-driven equipment. Evidence of this is the introduction of superheaters in connection with steam drilling plants.

Different types of insulation that involve different methods of application are now being given consideration and some are under test in the field. Factors that influence the selection concern the man in the field. Ease of examination of the boiler and pipe surfaces, especially the former, is one which is of extreme importance in the operation of high pressure boilers. Whatever the data of the many tests now being made disclose it is certain that problems of heat transfer will be greatly aided by a wider use and improved application of insulation in steam-generating and steam-using equipment in drilling operations.



Right—Protection over the upper half of battery of insulated boilers at drilling well. Oklahoma City Field.

Below—Galvanized sheet iron covering over boilers in use at a gasoline plant in West Texas.

Above—Connecting up boilers at drilling well preparatory to applying insulation. Oklahoma City Field.

Left—An insulated steam line between boiler house and drilling well.

Pipe Turning Device Used in Building Missouri-Kansas Gas Line

BY using a hand-operated pipe turning device in the application of an enamel protective coating on its 22-inch and 24-inch pipe used in the construction of a natural gas line from the Texas Panhandle to Springfield, Ill., and Indianapolis, Ind., the Missouri-Kansas Pipe Line Co., is estimated to be saving three tons of material on every mile painted.

This line is a combination welded and coupled carrier. The 22-inch pipe is lap welded and is used in the construction of the southwestern end of the job. The 24-inch pipe is seamless and is a recent product. Both diameters of pipe are random length joints and are sprayed with a priming coat at the mills. Another priming coat is painted on in the field. Virtually all of the welded joints are made at the railroad points where pipe is unloaded. This practice saves in welding costs because of fewer moves of welding equipment, saves in transportation costs and makes it easier to follow the company's plant of coupling every second or third joint with a coupling.

During the early stages of construction it was practice to weld two joints together and put in a coupling. This practice has been subjected to variation as construction of the line progressed.

Where the welding is done at central points the welders make more rapid time and it at the same time provides for better inspection of the welds. Upon the completion of each weld all of the scale is knocked off with a hammer and the weld and pipe adjacent to it is thoroughly cleaned with a wire brush to prepare the metal for the priming coat.

Because the welding is being done as described the stringing gangs are not far ahead of the painting gangs. There are two sets of crews handling the painting, one set applies the priming coat and the other crew applies the hot enamel coating.

Enamel gangs spreading coating on rotating pipe.

The priming coat usually is comprised of 22 men working approximately one-half a mile ahead of the enamel crew. This crew does not turn the pipe to apply the priming coat. Instead it paints the top half of the 40 or 60-foot joints and moves along to the next joint of pipe. Three or four hours later the priming crew returns to the point where they started. The joints are rolled over and the other side of the pipe is painted.

This method of working just a short distance ahead of the enamel crew permits closer co-ordination of work and at the same time permits ample time for the primer to thoroughly dry. The enamel crew is approximately half a mile ahead of the lowering and coupling gang and by thus working the painting so rapidly it is not deemed necessary to whitewash it.

Most of the interest on this project so far as coating is concerned centers around the mechanical application. The rotating device is constructed with angle irons. At the top of the device is a crank, connected by chain to sprockets which in turn rotate the rollers on which the pipe rests.

A boom tractor is used to raise the pipe and lower it to position on the rollers of the rotating device. The opposite end of the joint is likewise raised and lowered on rollers which serve as idlers. These are similar to the ones used on the rotating device.

Once the joint is on the device the coating is speedily applied.

Close-up view of rotating device used to turn pipe.

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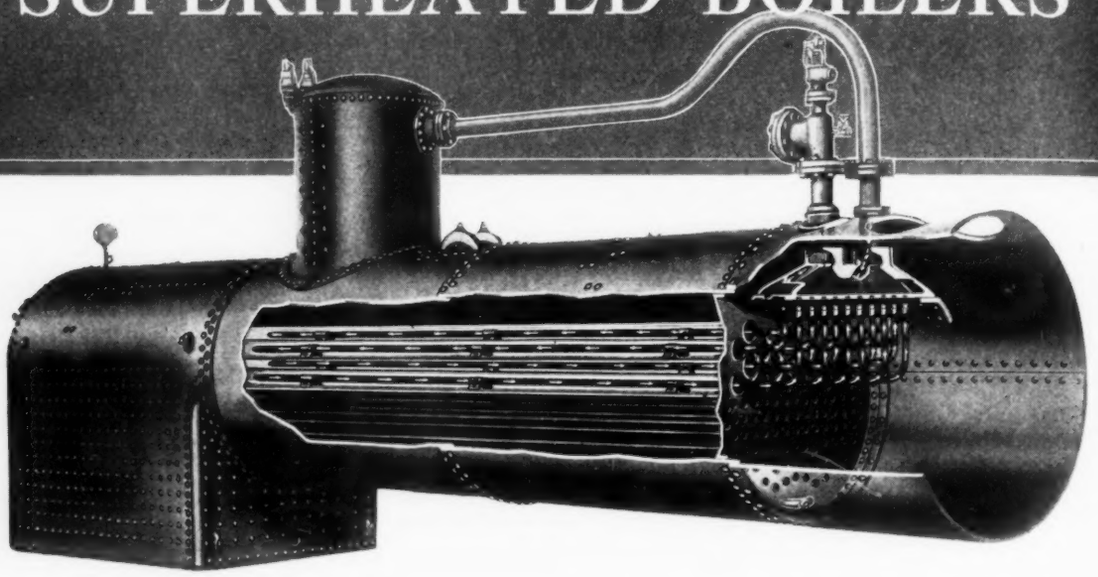
SUPERHEATED BOILERS



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2. Reduction in pipe line radiation losses from 39.3 boiler horsepower with saturated steam to 18.1 boiler horsepower with superheated steam.
3. Reduction of steam pressure drop in pipe lines from 26 pounds with saturated steam to 17 pounds with superheated steam.
4. Reduction of fuel consumption for some work done of approximately 26.2 per cent.
5. Reduction of water required for boilers of approximately 24 per cent.
6. Increase in speed and flexibility of the entire drilling rig.
7. Increase in capacity of the drilling rig, approximately 16.3 per cent.

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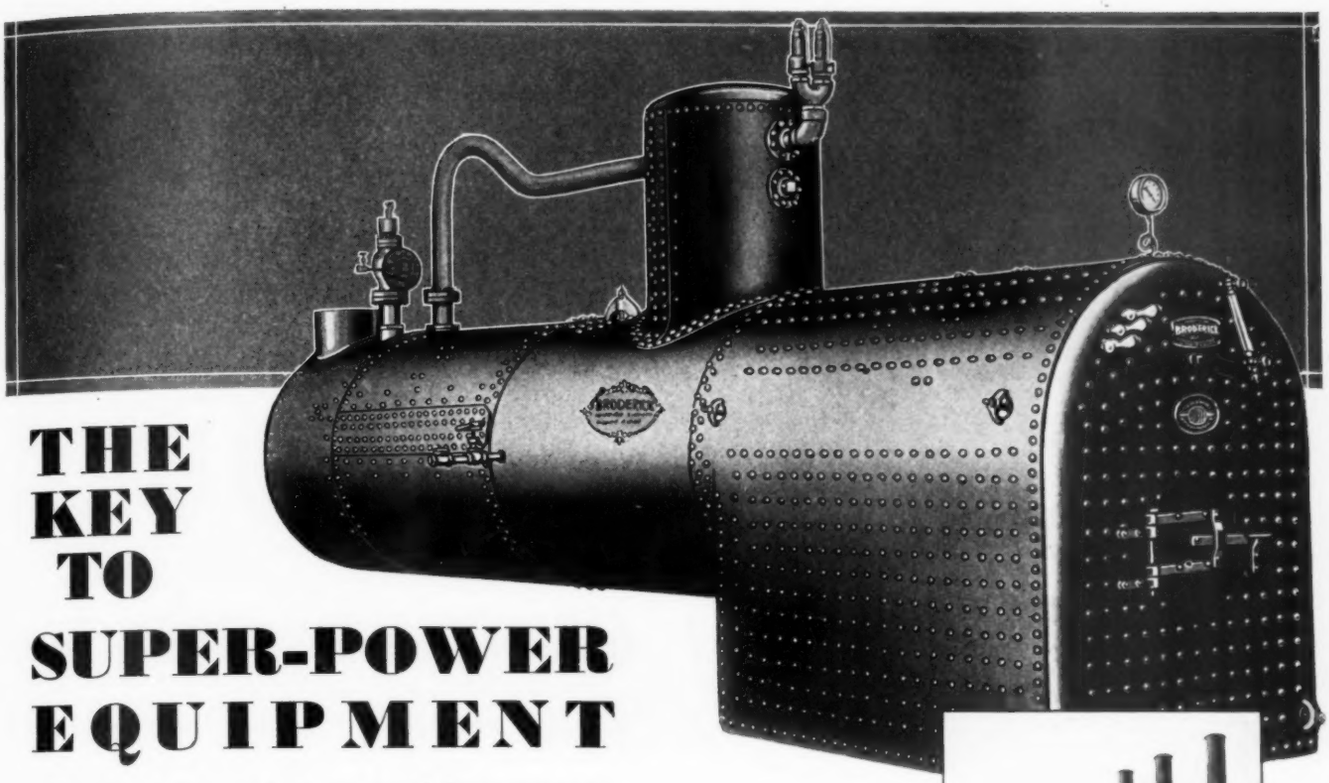

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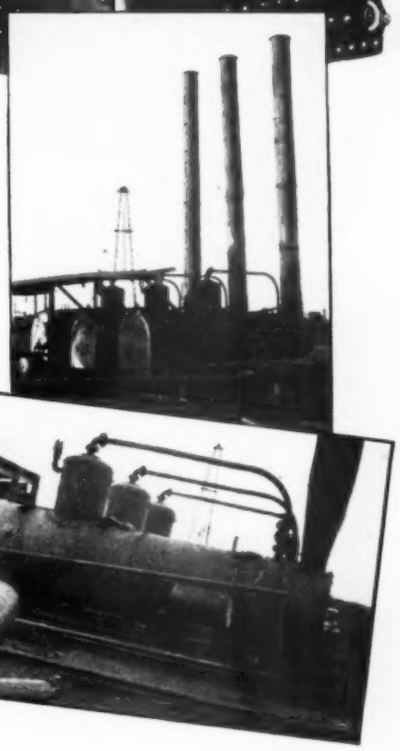

Two views of recent installations in the Oklahoma City field.

BRODERICK BOILERS
WITH
ELESCO SUPERHEATERS

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Most of the time six men working in pairs cover the pipe with the low penetration enamel. It is heated in field pots to a temperature of around 450 degrees and poured on the pipe from a hand pot. The other man working opposite the one pouring spreads the coating with an asbestos pad about eight inches square. He holds the pad close to the stream coming from the pot and as the pipe rotates the application is spread more uniformly.

Some prefer to spread the coating with canvas slings instead of with the pads or brushes. The relatively narrow brushes leave more ridges on the joints. Those preferring the canvas sling do so with the view of pressing out the air bubbles that might be passed over by the brush and at the same time get a more uniform coating.

Firing line gang working in the rolling country of western Kansas.

Either method brings about an appreciable savings in material. None of the enamel is splashed on the sides and bottom of the trench as is the case by working on stationary pipe. This savings, it is estimated, is around three tons per mile. It requires around seven tons of material to coat one mile of pipe on this job by using the above-described method. It is estimated that 10 tons would be required per mile if the material was applied by hand throughout.

The coatings are more uniform because the rotating pipe does not give the quick-drying enamel the opportunity to run to low places. There are six rotating devices used on the job and on an average of 36 men comprise the enamel crew. They are able to finish about one mile per day.

As soon as a joint is coated a tractor, working with the crew moves the joint off the device. A horse is used to pull the device away and on ahead to the next joint. The device has a wide bottom which permits it to be dragged without much trouble. By operating in this manner the coating crews can go from one joint to another with the minimum loss of moving time because by the time they finish one joint another is ready.

The two ends of the joint are not coated and are wire brushed after the enamel application to make certain they are clean before the couplings are put on. The enamel coating ranges in thickness from one-sixteenth to three-thirty-seconds of an inch.

A softer material is used in coating the couplings because it has more elasticity to yield to the sag at the couplings when the pipe is lowered in the trench. This material is applied by hand. All of the highway crossings are encased in 26-inch diameter pipe and they, too, are coated to protect them from corrosion.

Preparing to move rotating device to new location.

By using the semi-mechanical method of application it makes it necessary to handle the pipe more frequently and consequently subjects it to more chances for damage. Before a joint is lowered in the trench it is inspected to make certain the coating is not torn and whenever a break is found it is repaired by daubing.

The rotating method, too, is somewhat slower and requires more labor to complete the job. However, in the end, a more uniform and desirable application is obtained and the cost of approximately three tons of material is saved.

Three pipe line contracting companies have been awarded sections of the line and it is expected to be completed around December 1. Construction work is well along and virtually all of the pipe has been strung. This is the third of the major projects for gas transmission systems originating in the Texas Panhandle this year. The other two are the group building from the Panhandle to Lincoln, Neb., a distance of approximately 900 miles, and the group building the 24-inch Chicago, Ill., line. The former line also is a 24-inch carrier.

The most modern construction equipment is being used to build the Missouri-Kansas line and virtually every phase of construction will be mechanical or semi-mechanical. Considerable of the trenching has to be blasted and heavy machines are being used to remove the rock from the trench. About the only phases of the work done manually are coupling and welding, which are speeded along with the aid of tractors to line up pipe.

The construction work was so designed to get over the sections where the most trouble is expected from cold and rainy weather. Consequently all river crossings and low land sections are being completed as rapidly as possible.

Running concurrently with the line construction work the recently formed company's producing subsidiary has launched a drilling campaign in the Texas Panhandle. In addition gas reserves in the Hugoton area in Southwestern Kansas will be drawn upon in an effort to have from six to eight hundred million feet open flow capacity available December 1. The capacity of the main line will be around 200,000,000 feet daily. Present plans call for the construction of four compressor stations. Close behind the starting of construction of the line announcement was made from the Kansas City, Mo., headquarters of the company that additional orders for pipe had been placed to extend the line on north to Minnesota markets.

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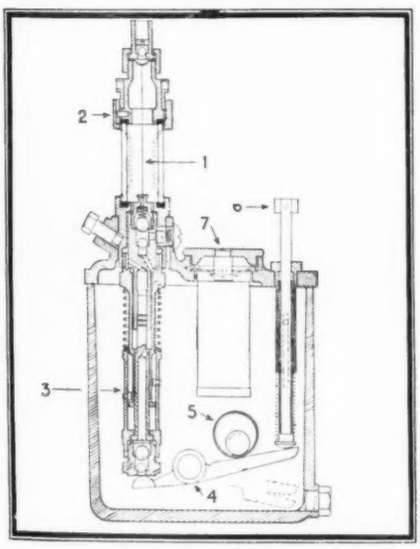
The operating eccentric (No. 5 in drawing below), is made from solid steel. Its simplicity, dependability and lasting qualities are just another reason for the popularity of the McCord "LF" Lubricator.



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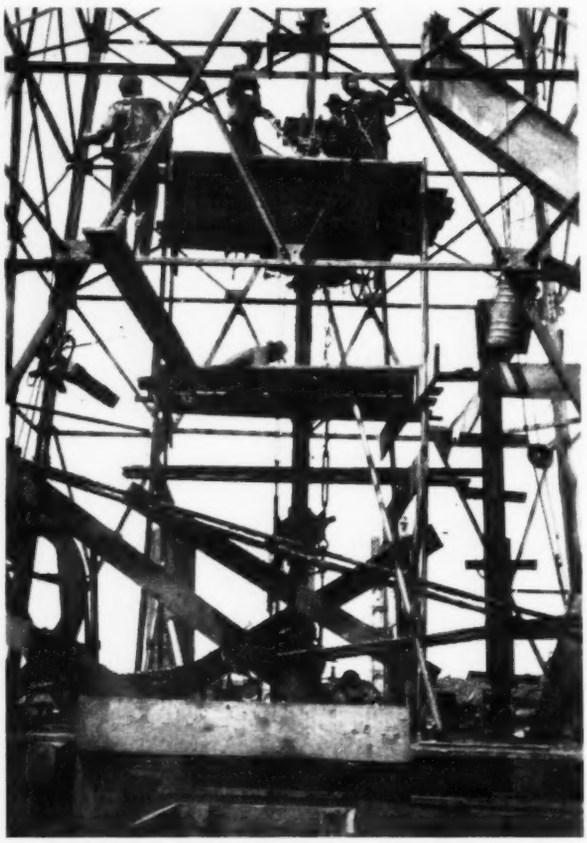
OKLAHOMA CITY Operators Are
Reducing Gas-Oil Ratio *by* Tubing

RECORDS on wells producing through tubing in the Oklahoma City field show that producers of this method have a smaller gas ratio to the oil output than previously. The employment of a smaller amount of gas pressure to flow the oil, naturally, means a longer flowing life for the well, because of this saving of natural pressure. This is highly essential in the Oklahoma City pool because of the deep producing horizon and sand conditions that will make pumping extremely difficult.

The ability to snub in tubing in these high-pressure wells, without the loss of any oil during the operation, has been quite a mechanical achievement. Because of the gas-oil ratio of some of the wells already producing through tubing there is a growing interest in this method of producing. The future will likely see additional companies using this flowing method, while those already experimenting with it will probably increase the number of wells that have been tubed.

The increased attention that has been devoted to the ways and means of controlling the gas-oil ratio from a producing well in the past year has caused oil men to watch with much interest the experiments conducted in various parts of the country along this line. During this time there has been an increased use of the method of flowing production through tubing to reduce gas wastage.

Because of this problem's great importance much interest has been shown in the attempts of Oklahoma City operators to better control the gas-oil ratio in the high-pressure producers of that field, where gas wastage is high. Several companies, including the Indian Territory Illuminating Oil Company, have studied producing conditions at Oklahoma City with the idea of some sort of control of the gas wastage.



Otis crew running tubing on I. T. I. O. Williamson-Canfield without killing the well.

These companies have tried running strings of tubing, either straight or taper, in their wells and flowing the production out of the tubing. This has proven quite satisfactory and has reduced the amount of gas produced with the oil flow.

A good example of the tubing efforts to control the oil-gas ratio in the Oklahoma City field by the Indian Territory company is its Williamson-Canfield No. 1, in the SE SE SW Section 24-11-3w, which was its first tubing producer.

The Williamson-Canfield well was originally completed on December 18, 1929, with an initial production of 183 barrels of oil, 96,000,000 cubic feet of gas, with a back pressure at the well head of 150 pounds. The producing horizon is the Detrital zone from 6180-6366 feet, with the total depth 6387 feet in the Siliceous or Arbuckle limestone. The 6⅝-inch O. D. casing was set at 6271 feet, which left 115 feet of open hole.

The well's greatest production prior to running the tubing was 871 barrels in 24 hours made during April, 1930. This flow was made with 28,000,000 cubic feet of gas, against a back pressure of 1000 pounds at the well head. Gravity of the oil was 54 degrees at a temperature of 60 degrees.

Since being placed on the tubing method of flowing production the well has been making 1150 barrels of oil and 12,000,000 cubic feet of gas, with a back pressure of 120 pounds at the casing head. The gravity of the oil is now 39.2 degrees Baume at a temperature of 60 degrees F. The lowering of the gravity has reduced the amount of valuable wet molecules previously escaping with the gas.

There is a combination string of tubing in this well. It consists of 2683 feet of 4¾-inch, 16-pound casing, and 3600 feet of 3-inch, external upset, 9.3 pounds, tubing. The bottom 20 feet of tubing is perforated with 225 holes of three-eighths inch diameter. The bottom of the tubing has a bull plug, forcing the flow to come in through the perforations.

This well was dead at the time the tubing was set, and was hooked up for artificial pressure. It kicked off at 850 pounds pressure after rocking the pressure flow from the tubing to the casing and back and forth four times. That is, the pressure was first put into the hole through the tubing, then switched to the casing, etc. It started flowing through the tubing at noon on June 9, 1930.

It can readily be seen that the well made more oil and less gas on the tubing type of flowing than previously, while at the same time no trouble was experienced with sand cuttings, since the perforated pipe should have a tendency to reduce the amount of sand entering the hole, and also to reduce its velocity.

A slightly different hookup was used on the Indian Territory Illuminating Oil Company's Trosper 3 well. Tubing was used all the way down, instead of a combination casing and tubing string. A total of 3281 feet of 3-inch external upset tubing was run and 3018 feet of external upset 4-inch tubing, weighing 12¾ pounds. This was snubbed in under a well-head pressure of 1700 pounds at the start, and while being permitted to produce.

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IN the relatively short time that pipe line companies have given serious consideration to safety work not only in station operation but every phase of line construction and operation, the campaigns have brought about a great reduction in accidents. In turn this has resulted in a much lowered cost from lost-time accidents, less damage to tools and equipment and vastly improved working conditions.

The Oklahoma Pipe Line Company has for many years given safety work the consideration that produces results. An example of how this work is carried along may be observed at its Seminole tool house, which only a few months ago settled down after the beehive activity characterizing the building of a large gathering system.

During such occasions employes frequently tussle on the warehouse dock before working hours and unless sharp-pointed tools are protected serious accidents are likely to follow. The picks were racked in a frame made with 2-inch and 1-inch pipe. Going a little farther an old tank plate was fashioned into a sliding door and put on the front of the rack. Thus, should anyone fall against the rack the door would prevent their back from reaching the picks.

Other sharp tools are also racked and in places where it would be difficult to knock them down. Most of the racks are built so the tools have to be lifted upward and then out before they can be removed.

Drills and bars are frequently hard to find and when out of their places sometimes cause serious accidents. A receptacle, as illustrated, was made out of old 10-inch pipe welded together and mounted on a rack to eliminate the above-described source of trouble. A door was fashioned and may be locked.

Hundreds of accidents have been caused by tongs skidding off a rack on a workman's foot because he removed it by grabbing the reins and jerking it off. By building an A frame rack with a rail around the top part the tongs cannot be removed by pulling the reins outward. In order to remove them the workman has to stoop down, lift them up from bottom to get them off the bottom rail and then lower them to the ground. The bottom section is utilized for jacks, etc.

Chain tongs also racked on an A frame and each tong is held secure in its place with a latch. When it is desired to remove them from the rack the latches are moved and the tongs lifted out. Pipe cutters are racked on the wall by the handles in hook racks, making it necessary to lift them upward for removal.

Top to bottom—Rack for chain tongs. Rack for pipe tongs. Receptacle for pinch bars and drills. Pick rack with sliding metal doors.

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This photo shows the portable spiral wrapping machine in successful action on its first trial.

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Suggestions *for* Vapor Line Hook-Ups

By CHARLES P. BUCK, *Industrial Engineer, Topeka, Kansas*

INSTANCES sometimes occur where vapor recovery systems fail to attain a satisfactory efficiency in operation. The individual pieces of control equipment, when checked, are found to provide the degree of close and sensitive regulation essential to the narrow pressure margins permitted, yet there persists a lack of estimated capacity, chattering valves and other phases of trouble. In such cases the difficulty is apt to be found, not in the control equipment, but in a lack of sufficient vapor line capacity.

In one case of this sort the specifications for the project, which was the recovery of gas and vapors from flow tanks in the field, were carefully considered and rigorously drawn. Many of the tanks were old, and of light construction. The residue gas from the natural gasoline plant which treated the vapors, was sold to a fuel distributing company; hence it was essential that the air content of the recovered gas and vapors should not be increased. Thus it was specified that there should never be vacuum on the tanks. Tank valves were to relieve at one-ounce pressure per square inch, and regulators were to open at three-quarters-inch water-column pressure and to close at atmosphere. The capacities of the regulators, for each nominal pipe size, were stated for the given conditions of control. Notwithstanding the care with which the project was undertaken, trouble immediately developed at one or two of the flow tanks. At one certain tank the relief valves were popping off continuously, so that a great deal of rich, vapor-laden gas was wasting to the air. At the same time, the meter chart showed that approximately 30 per cent of the rated capacity of the regulator was occupied by the gas passed to the gathering line.

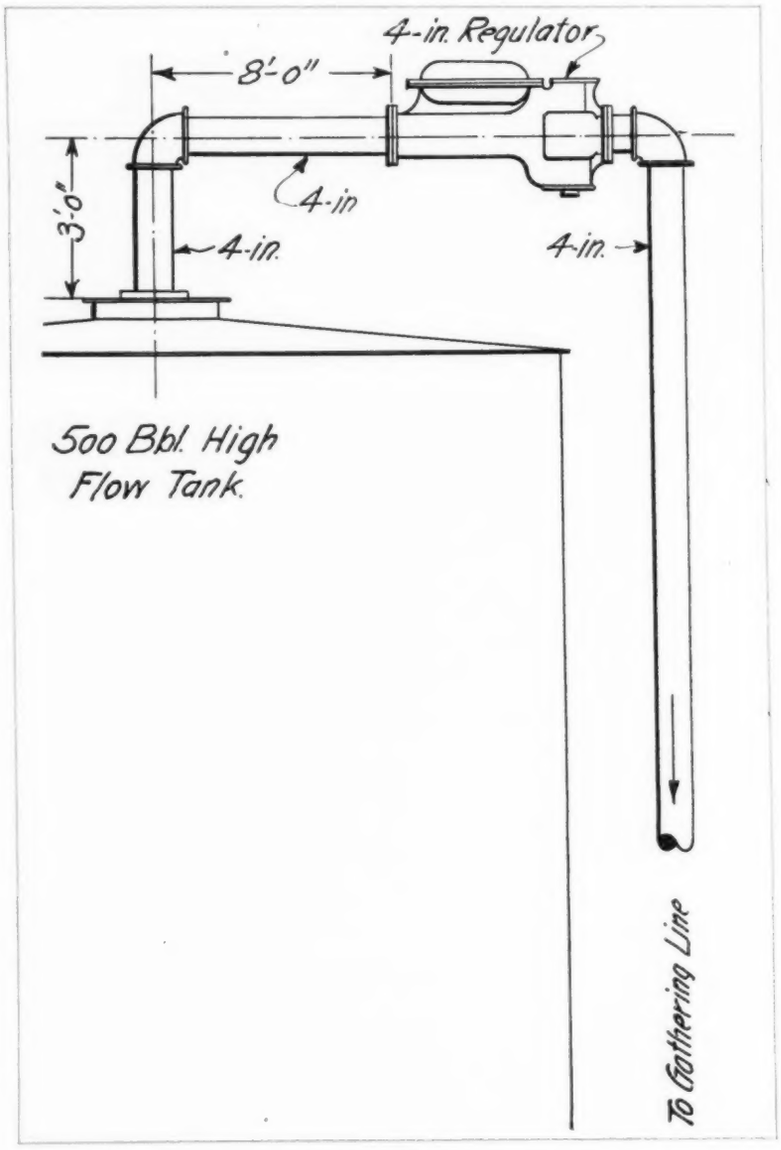

Fig. 1

A check of the situation disclosed a condition as shown in Fig. 1. The piping job, done by the owner's men, was a good one. Pipe was new and clean, as were elbows, tees and other fittings. Gaskets were cut clean, round and smooth. Vacuum in the gathering line was 7 inches mercury, indicating that the line was not overloaded. Notwithstanding the high vacuum at the regulator discharge, gas was blowing-off at the tank with both relief valves wide open. There was no manometer tap at the regulator intake, so it was impossible to observe pressure at that point.

By manipulating the regulator valve by hand it was found that it could be forced open against the diaphragm pressure until the pressure in the tank was reduced below 1 ounce and it was thus apparent that the trouble did not lie in lack of capacity in the regulator. But in so doing, it was noted that when the tank pressure was reduced below the relieving point of the valves, vacuum at the regulator intake dropped to 5 inches of mercury. The trouble was at once apparent; the capacity of the line from tank to regulator was far too small.

The 4-inch riser, tee and horizontal run to the regulator (see Fig. 1) were changed to 6-inch, and connected to the regulator with a 6 to 4-inch swaged nipple, as shown in Fig. 2. A manometer tap was provided both at regulator intake and discharge. The line was again hooked up and everything functioned perfectly. The volume of gas passed, as shown by the meter, rose from 265,000 to 875,000 cubic feet per 24 hours. Pressure in the tank dropped to slightly below the specified 1-ounce per square inch; the valves no longer popped off; the waste

HABIT

SAYS OLD METHODS ARE SUFFICIENT

PROGRESS

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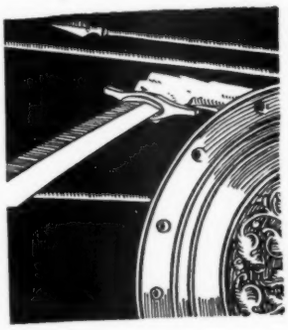

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of rich gas was stopped. The heavy increase in volume of gas passed to the gathering line reduced vacuum therein from 7 inches to slightly less than 3 inches mercury.

The original 4-inch downcomer to the gathering line was retained. The increase in volume recovered was obtained wholly by the increase in pipe size from tank to regulator intake. It must be remembered that the function of the regulator is to safeguard the tank, that is, to prevent the "suction" of the gathering line from running back in the pipe. Regulation is at the intake of the regulator or, rather, at the valve of the regulator, which acts as the automatic sluice-gate of a dam. Thus with the small pipe the volume actually passed was the maximum that could be forced through the riser, tee and horizontal run of pipe at the 1-ounce head maintained by the relief valves, that is, at a pressure drop of 1-ounce.

In the corrected installation shown in Fig. 2, the drop in pressure head in the 4-inch downcomer to the gathering line (over 4 inches mercury) well indicates the great friction loss in small pipes.

The use of a swaged nipple, as in this instance, is often indicated. It obviates the necessity of carrying in stock regulators of varying and diverse intakes and outlets, thus making a stock of such instruments much more universally available.

For example, gas is taken through a 2-inch line from a main at 50 pounds gauge pressure, and expanded through a regulator to a pressure of 2 pounds. The volume of the gas is expanded about four times. If the run is even of but moderate length, this will indicate a 4-inch pipe. Instead of requisitioning a regulator with 2-inch intake and 4-inch discharge, the engineer will show a standard 2-inch by 2-inch regulator, with 2-inch to 4-inch swaged nipple set at the discharge, as shown in Fig. 3.

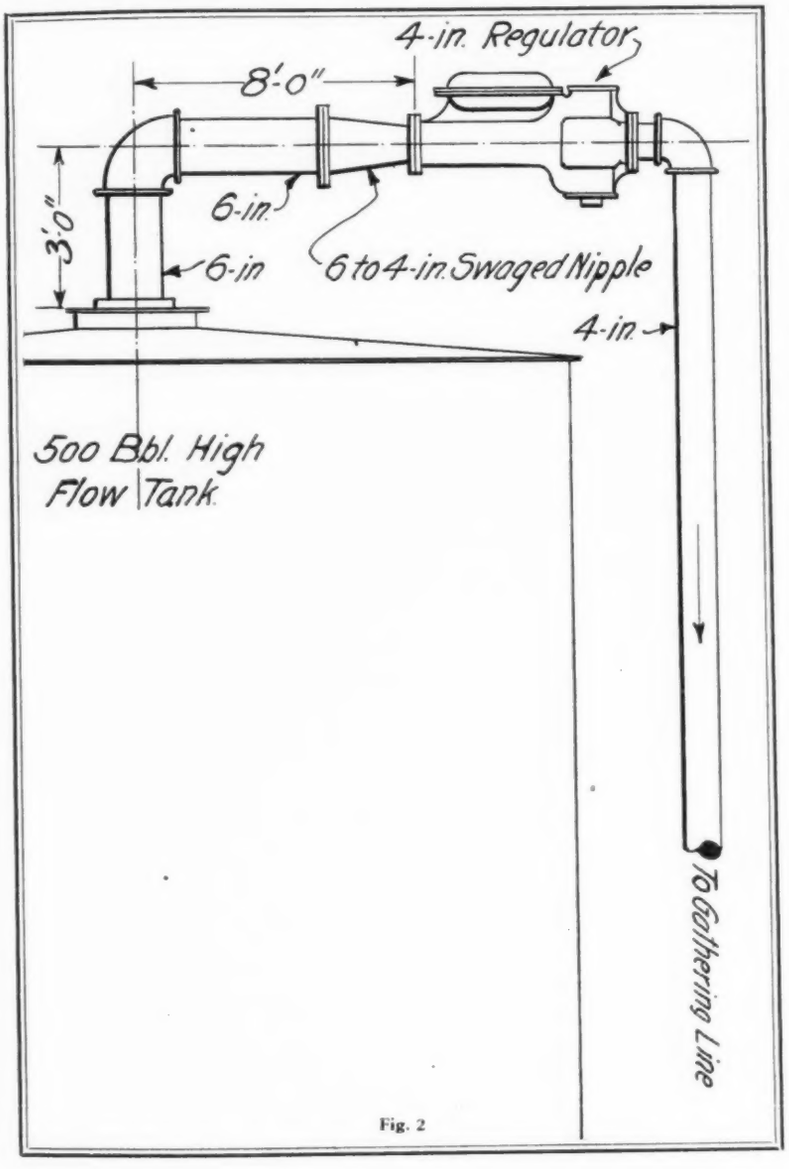


Fig. 2

The availability of the swaged nipple for this purpose lies in its close approximation to the form of a true nozzle. It functions just as does the upstream or downstream end of a venturi tube, converting pressure head into velocity, or, conversely, velocity into pressure head, without appreciable loss of energy.

In hooking-up vapor recovery lines to production tanks the engineer must, perforce, be governed by the requirements of the production department. Fig. 4 illustrates a condition which sometimes is encountered and, as well, the operating troubles engendered by the hook-up which the situation developed.

In this case the production superintendent was very much averse to having any of the natural gasoline plant crew "climbing up over his tanks". Consequently the sensitive regulator was installed on the ground outside the dike (as shown) and connected with the tank by two swing-joints made up of two elbows and a short nipple. The volume of gas fluctuated considerably, as the well flowed by heads. During the peak of the flow, gas was lost by popping-off. Between heads the regulator chattered badly. In this case, naturally, the regulator man was called in, as it would appear that the fault was his. Examination of the hook-up indicated that at the very low pressures for which the flow tank was valved, as well as the low pressures for which the regulator was set, the resistance of the piping was too great. The pressure drop through the connecting vapor line with its many turns and elbows was so great as to cause the gas to pop off during the flow peaks because the resistance of the line, measured in pressure drop, was greater than the sensitivity of the regulator. Thus, at the low tank pressure periods, the line would fill with gas at a pressure which caused the regulator to open. The regulator, an extremely sensitive instrument, opened wide permitting gas to flow into the gathering line at great velocity. This caused an instantaneous drop in gas pressure at the regulator intake as the resistance of the line prevented gas flowing immediately from the tank to restore the pressure at the regulator intake; and the sensitive instrument closed. The pressure then was immediately restored, the regulator instantly opened, and the cycle was repeated, causing the rapid fluctuations diagnosed as chatter. The loss of gas was, to the production superintendent, a greater calamity than a breaking of his established prejudice against the activities of the natural gasoline plant crew. The installation was changed about as shown in Fig. 1 and all trouble ceased. All gas was recovered as it was produced, the regulator no

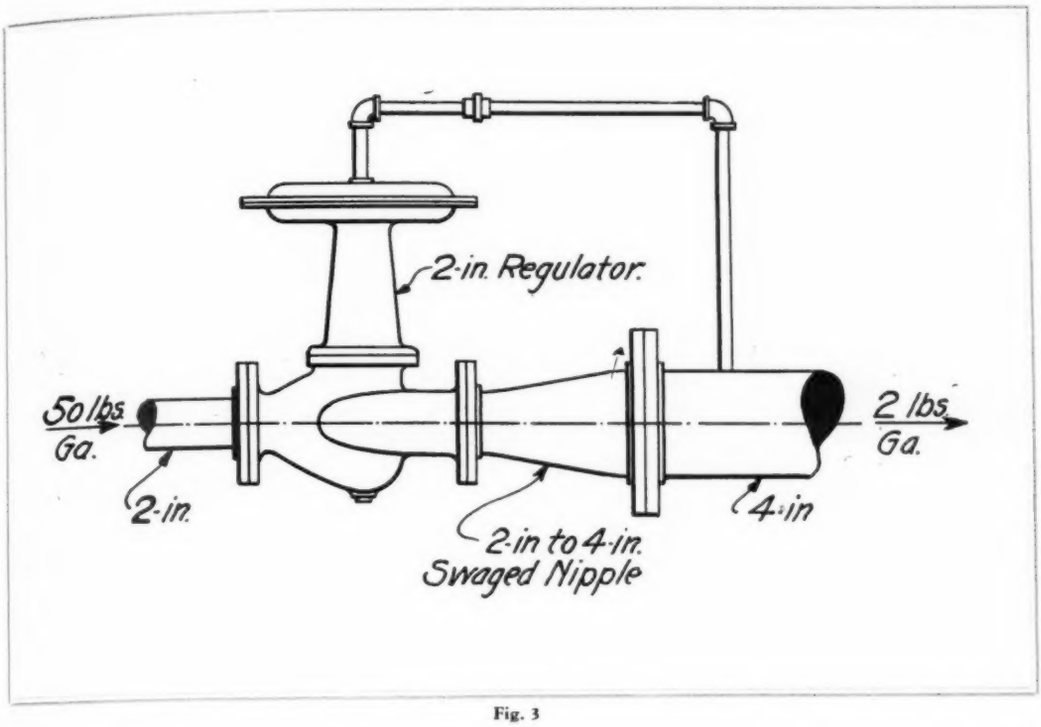


Fig. 3

longer "chattered", the ragged line on the meter chart became more normal, and both gasoline plant and producer made more money with far less tribulation.

These instances illustrate the importance of careful and considered calculation of vapor line capacities at the pressures assumed for the safety of tanks and other equipment. No matter how carefully specifications for control equipment may be drawn, they may be utterly set at naught if the resistance of connecting piping is allowed to build up to a point which is greater than the sensitivity of control.

Remote control of regulation is possible, and, many times, feasible. But it must be remembered that gas is an elastic fluid, and this elasticity induces a lag in control lines by reason of their resistance. That means, usually, right at the tank. The ideal method is to install the regulator right in the deck of the tank wherein it becomes a part of the tank itself. The objection is, of course, that it is usually highly undesirable to do any cutting in tank decks after they are in use. With the degasification of oils from the deeper sands a problem of increasing importance, it is going to be desirable and profitable to install flow tanks of large capacity between trap or separator and stock tanks on the lease. Time is a function in the elimination of gas from oil. Dissolved gas, as it is eliminated from the oil, carries the gasoline fractions (light ends) with it. It is the one great adventitious aid to natural evaporation.

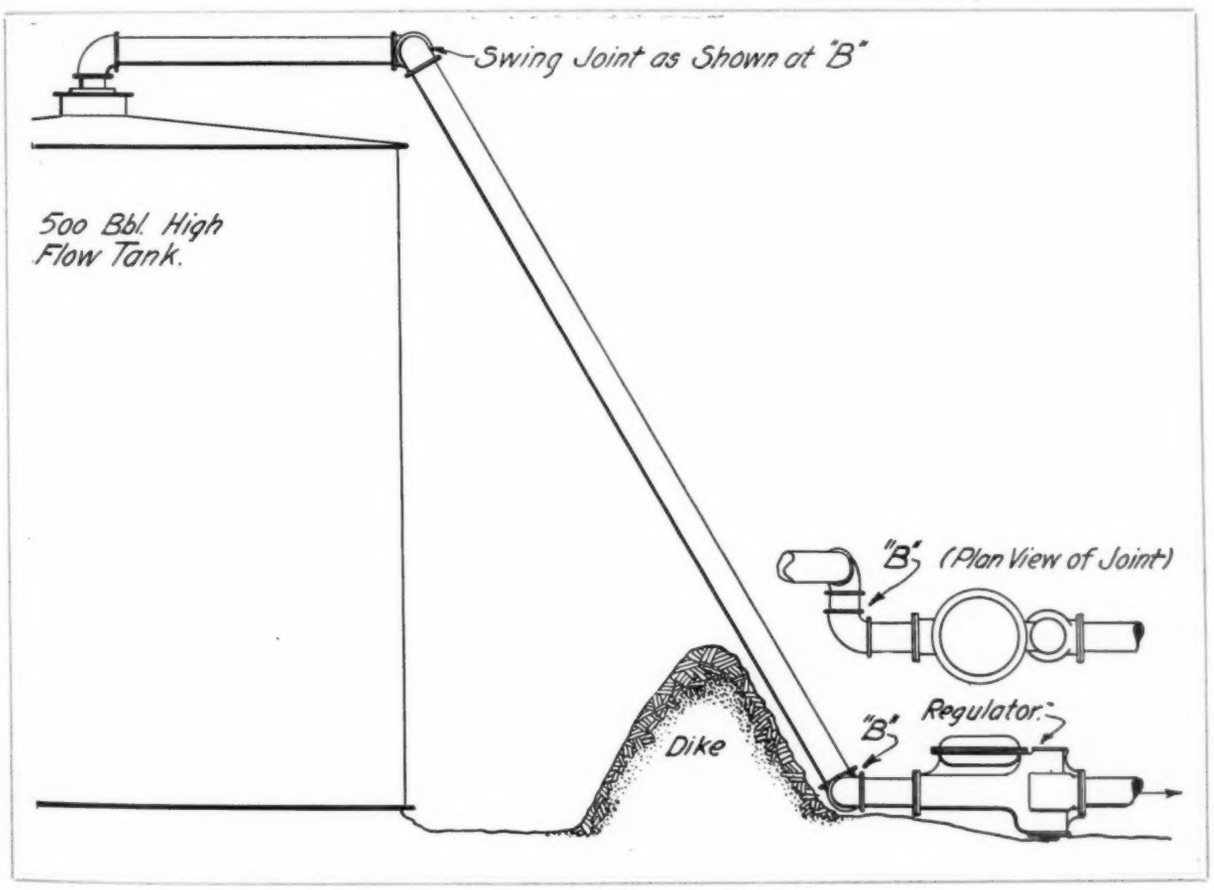
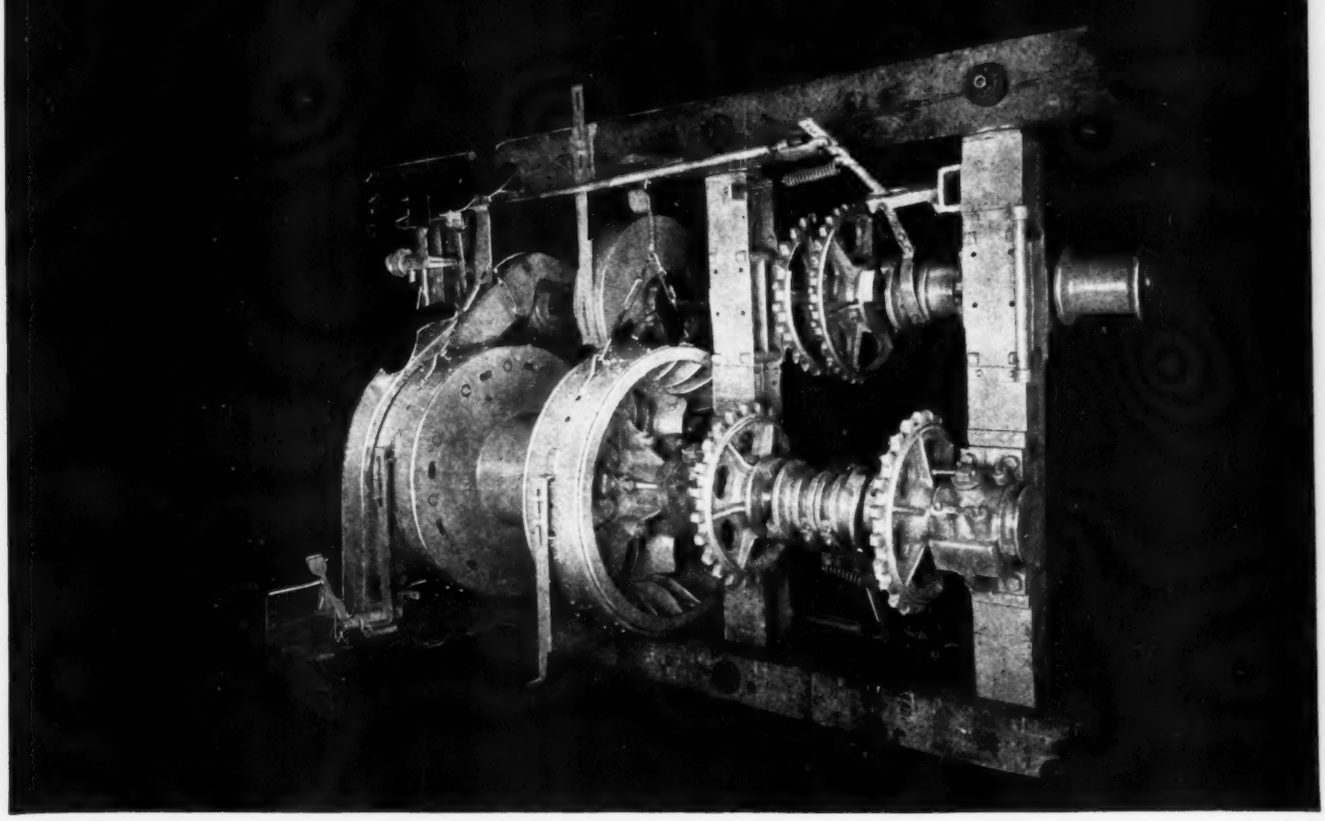


Fig. 4

IDECO BOYKIN



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The IDECO-Boykin runs smooth and runs fast.

Has three speeds. Clutches are shifted by the foot, leaving the hands free.

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Big diameter of the spool provides speed in hoisting and longer life to wire lines.

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The shafts of special analysis steel are ground and polished. Chrome nickel clutches and sprockets—of heavy weight.

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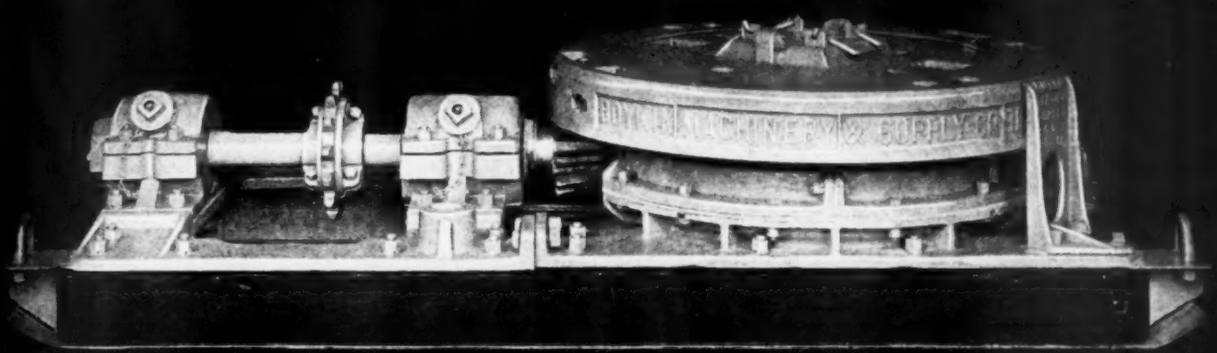


THE Ideco-Boykin Rotary has earned its reputation over many wells in the deep well districts of the Gulf Coast.

It is the Make and Break type—and is offered in 19, 23 and 27 inch sizes.

The Ideco-Boykin is built low to make it easy for the drillers to pull the slips.

An unusual oiling system—oil bath—the entire system easily drained.

Rotary table is fully enclosed. Mud cannot get into the bearings.

Pinion Shaft is mounted on Hyatt Roller Bearings.

The Ideco-Boykin Rotary will do everything any straight rotary will do, and in addition to the make and break, the fishing job feature is especially valuable. With it you can come out of the hole and break joints without twisting or rotating the pipe even a single turn in the hole.

Write for complete specifications

Operating Features of Trosper Park Gasoline Plant

•

THE natural gasoline plant at Trosper Park in the Oklahoma City field is owned jointly by the Cromwell-Franklin interests and the I. T. I. O. Co. An eight-point temperature recording instrument is installed in the laboratory so that the chief chemist and superintendent can check the plant operations from the laboratory. The instrument records continuously the temperatures of various systems in distillation unit and absorbers. This includes temperatures on both the lean and rich oils.

The Trosper Park plant started operations early in May of this year. It has a capacity of 30 million cubic feet per day. The most modern type of equipment has been installed.

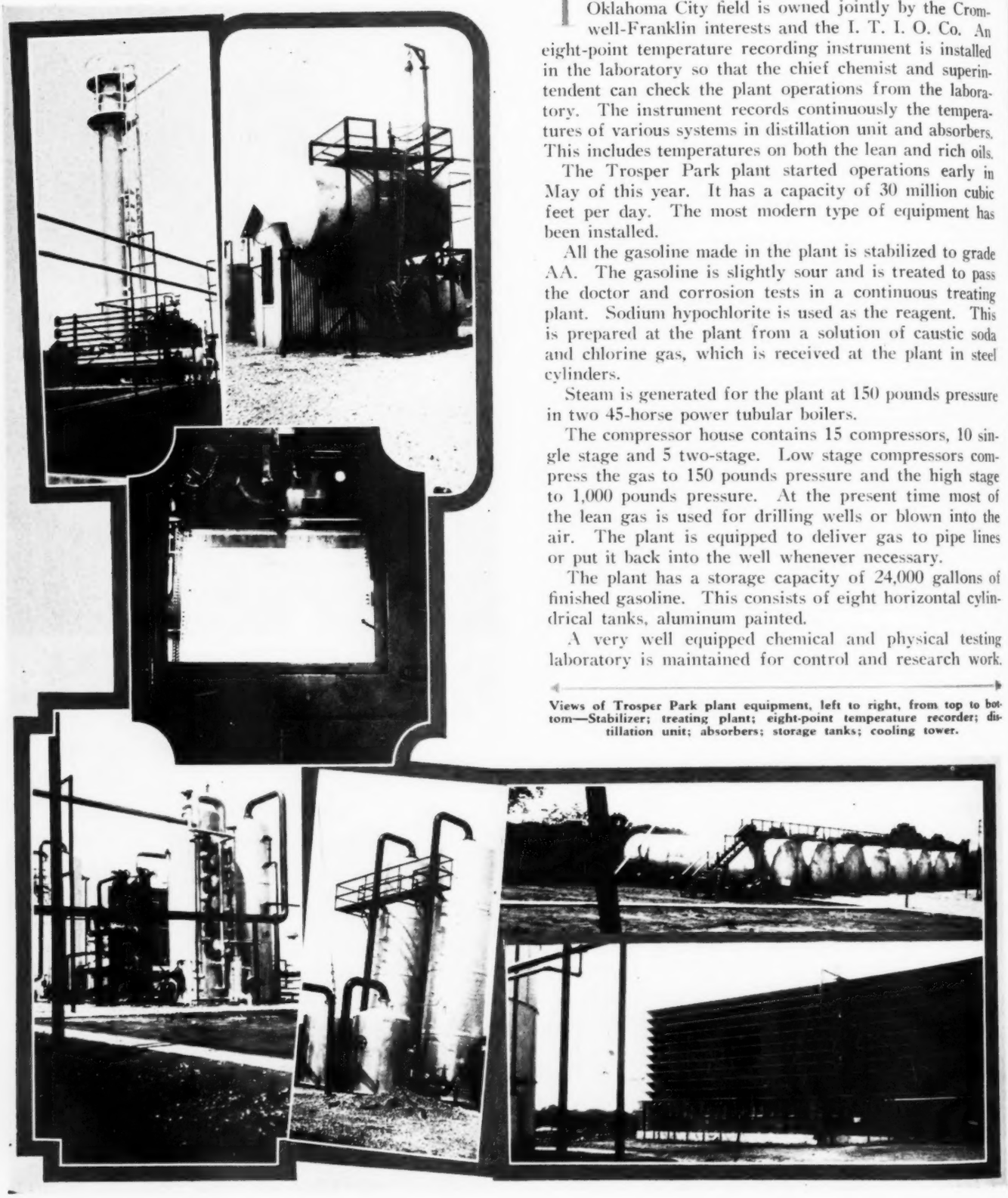
All the gasoline made in the plant is stabilized to grade AA. The gasoline is slightly sour and is treated to pass the doctor and corrosion tests in a continuous treating plant. Sodium hypochlorite is used as the reagent. This is prepared at the plant from a solution of caustic soda and chlorine gas, which is received at the plant in steel cylinders.

Steam is generated for the plant at 150 pounds pressure in two 45-horse power tubular boilers.

The compressor house contains 15 compressors, 10 single stage and 5 two-stage. Low stage compressors compress the gas to 150 pounds pressure and the high stage to 1,000 pounds pressure. At the present time most of the lean gas is used for drilling wells or blown into the air. The plant is equipped to deliver gas to pipe lines or put it back into the well whenever necessary.

The plant has a storage capacity of 24,000 gallons of finished gasoline. This consists of eight horizontal cylindrical tanks, aluminum painted.

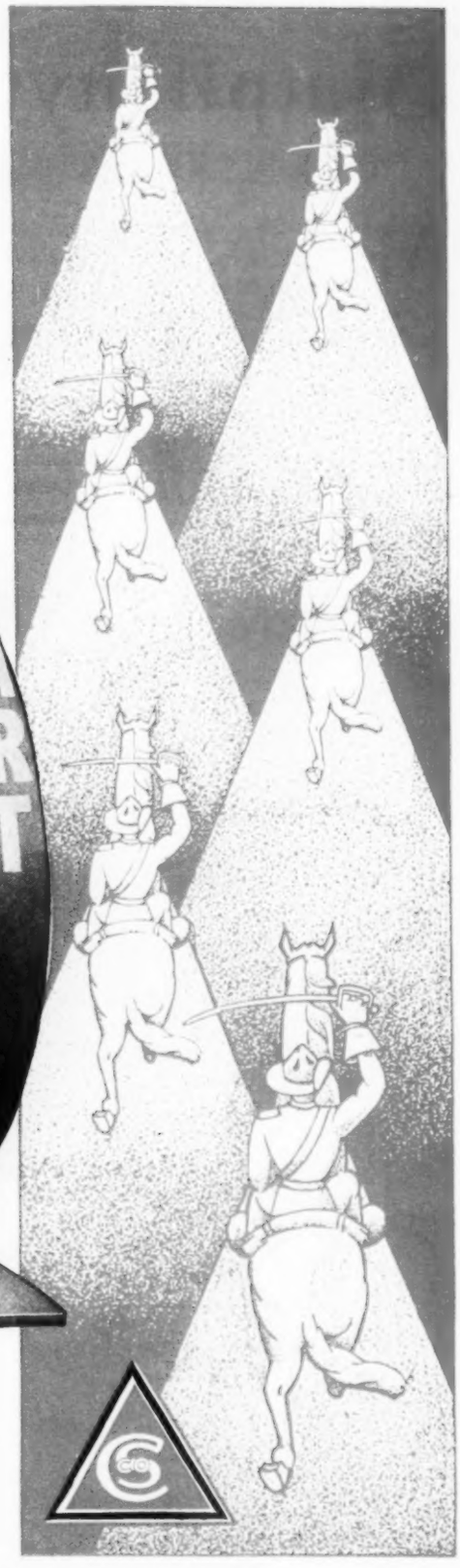
A very well equipped chemical and physical testing laboratory is maintained for control and research work.



Views of Trosper Park plant equipment, left to right, from top to bottom—Stabilizer; treating plant; eight-point temperature recorder; distillation unit; absorbers; storage tanks; cooling tower.

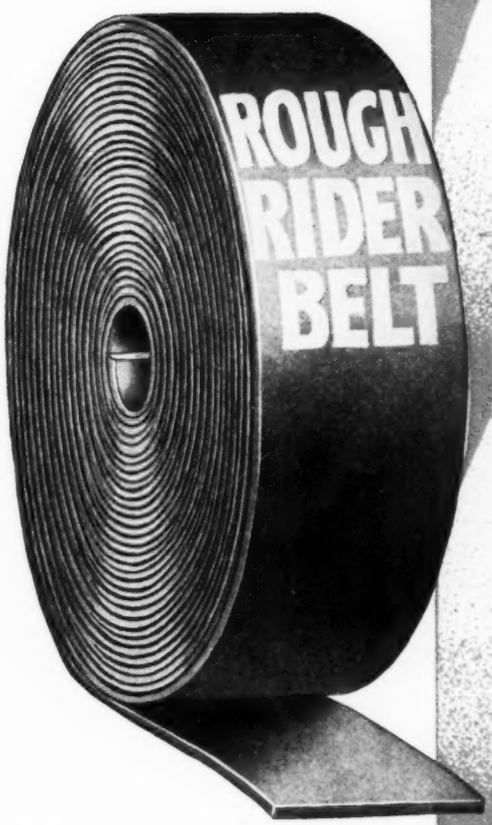
NO JOB TOO TOUGH!

Rough Rider Belt



Rough!
Tough!
Never Get Enough!

Battle Cry of the Rough Riders



CAREFUL selection of materials, painstaking attention to minute details of manufacture, and ample knowledge of service requirements have produced in Rough Rider a belt for the toughest service.

The following products live up to the battle cry of the Rough Riders—

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Simplicity of Design Features

MUNCE STATION, the 10,000-horsepower and master unit of the Arkansas-Louisiana Pipe Line Co.'s gas transmission arteries, is a plant embracing the most modern features in station design and operation. The simplicity of the station piping layout, the large basement for piping and storage, ample facilities for natural lighting in the station and basement, the concrete work, the elaborate measuring station and the safety features all lend themselves to the common aim of safe, low-cost and attractive operating conditions. The auxiliary plant is likewise in step with the general design of the station. Provisions for housing and promoting a congenial spirit among employes have been carried to an unusually high degree.

This month's front cover picture is an aerial view of the gas measuring station at the Arkansas-Louisiana Pipe Line Co.'s Munce compressor station near Sterlington, La. Seven producing companies deliver gas to the station and 42 meters are housed in the building. Seventy-six gate valves are required.

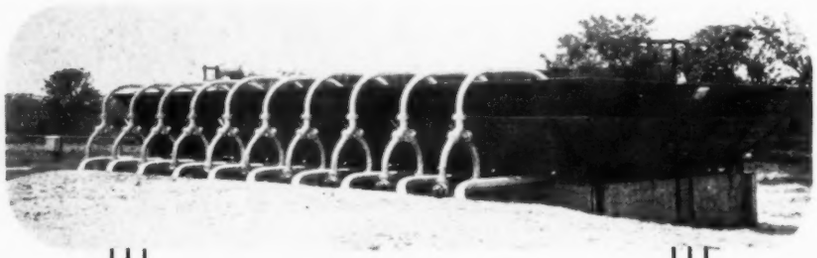
The station is located near Sterlington, La., and in the heart of the expansive and venerable Monroe gas field which, with the nearby Richland field, produces gas for markets in nine states through hundreds of miles of transmission lines.

It was named in honor of J. R. Munce, vice-president of the Arkansas Natural Gas Corp., who has been prominently identified with the oil and gas industry for years, both in the East and Southwest. The station is on a site 87 feet above sea level and on the banks of the Ouachita River, one of the most picturesque in Louisiana.

Munce station was designed by the Republic Construction Co. of New York under the direction of George Sethoff, president. Construction work was started July 1, 1929, under the supervision of M. J. C. Ferguson, vice-president and general manager of the designing company. The first engine was turned over 107 days later and on October 31st the plant was started in actual operation with two engines running. Around the first of the current year all 10 of the 1,000-horsepower engines had been tested and broken in, and the station completed except for some of the landscaping.

Because of the sandy soil and quicksand condition in that section as well as in other sections of the Pelican state, an elaborate foundation was required to reduce vibration of the reciprocating engines to a minimum. Engineers stated that with each stroke of the pistons the equivalent of a 90-ton blow is delivered to the foundation. Each twin engine operating at 125 r. p. m. will impart 500 such blows per minute.

Specifications called for 462 thirty-foot concrete piles, each calculated to carry a load of 30 tons, to be driven under the main engine piers and the building walls. At



After cooler at Munce station.

Main building

Munce Gas Station in Louisiana

each end of the engine piers four piles were driven at an angle of 11 degrees to better resist vibration in the sandy soil. After the piling had been driven a reinforced concrete mat three feet thick was poured solid. The engine piers and building piers were tied to the mat.

An idea of the enormous weight resting on the piling may be gained by the contractor's estimate that 9,442 tons of concrete, 1,430 tons of engines, 200 tons of structural steel, 35 tons of sheeting and roofing, 40 tons of cranes and 50 tons of piping rest on the piling. This makes a total weight of 11,300 tons or 24½ tons to each pile.

To isolate the vibration of each individual engine, preventing it from being transmitted to the other engines or to the building proper, cork insulation was laid around the units when the tapered inverted floors were poured. The floor was poured solid and is approximately 12 inches thick where it ties to the engine pier and tapers down to 6 inches in depth as it is built outward. The cork insulation has been put in completely around the engines at the point where the floor would otherwise connect with the building and half way between each engine. Thus vibration, in territory where adverse soil conditions are present, has been reduced to the minimum and when all engines are running and in step the vibration is hardly noticeable.

The main building is 275 feet long by 68 feet wide and has a heavy steel frame covered with sheet metal. Some of the building features are chain-operated steel rolling doors, chain-operated continuous steel ventilating sash, roof ventilators and two 15-ton traveling cranes.

The two huge steel rolling doors on either side of one end of the building will permit a loaded car to be shunted into the station. The engine room floor level is five feet above the ground level. Thus when heavy equipment is brought to the station the truck is driven inside and the equipment unloaded with the crane.

There is one standard sized door in the opposite end of the building and others along the sides. Entrance to the basement is gained from either end of the building or through two of the hatches inside the engine room. Inasmuch as there is ample space in the basement between each

Interior view of the ten 1,000 horse power double-acting compressors.

at Munce station.

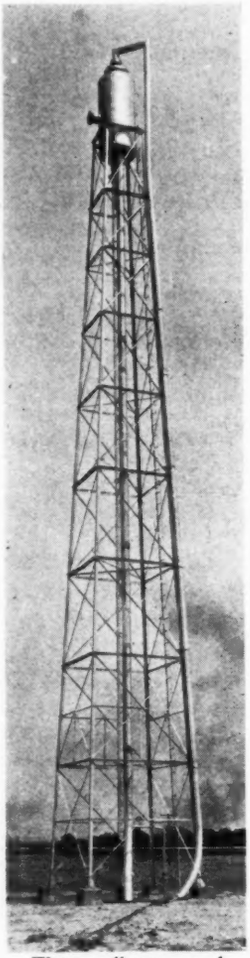
engine foundation many of the heavier spare parts are stored there. When needed the crane hook is lowered through the hatch and the part lifted out in that manner.

Equipment in the engine room consists of ten 21½ by 36 twin-tandem, double-acting engines directly connected to 13½-inch double-acting compressors. Each engine has a rating of 1,000 horsepower at 125 r. p. m. One of the features connected with the erection of the engines was the installation of brass pipe for all of the water piping up to and including 2-inch. This was done to save future and expensive replacement of corroded water pipe.

The piping layout is probably one of the most interesting features connected with the station. In the basement on the engine side of the plant are the lines for the fuel, water air and heating systems. The basement affords ample head room to make repairs and the lines are far enough apart to be readily accessible.

The 20-inch fuel header extends the entire length of the basement and rests on T-iron pedestals on the floor. Five-inch fuel lines, with gates on the riser lines from the header, extend to the engines. Each engine's fuel supply goes through a regulator and volume tank located in the basement.

Just above the fuel header and resting on steel braces set in the floor and to the wall is the cooling water header. Above these two large lines are the smaller lines for starting air and hot water for the heating system. The exhaust pipe is carried overhead along the outboard side of the engine foundation. It is suspended from the basement ceiling and is leveled with turnbuckles. To compensate for expansion the pipe is anchored horizontally. Provision is also made for any expansion and vibration of the mufflers by mounting them on rollers built with short lengths of 2-inch pipe.



Water well tower and combination flow head and separator.

With the exception of two water lines and a bleeder line the only piping on the compressor side of the station are the suction and discharge lines. Gas is taken to the compressors through two 8-inch suction lines, one on either side of the unit, and delivered through two 6-inch lines converging into an 8 by 6 by 6 wye. The 10 independent discharge lines go to a 10-section bent tube gas cooler and from there to the main lines.

Munce station machine shop.

Two 20-inch headers receiving the gas from the measuring station supply the compressors. The two headers are sub-divided in such a manner as to really constitute three headers and by the system of gate valves the station crew is enabled to separate incoming gas from the measuring station under varying pressures and use one or more compressor units to pump from each header, or all 10 units on one, or all three headers at one time, as necessity requires.

Each line has a gate, of course, at the header, and extension gates have been installed near the station walls to permit opening of the discharge gate from the interior of the station. Thus one man may start the units after setting the outside gates. The gate on the suction line is also inside and by closing the discharge gate from the inside, opening the by-pass, one man may start a unit.

In the wye connection of each discharge line is a bleeder line which ties into a header terminating in the fuel gas line. Thus if it is necessary to repair an engine to the extent that some of the gas in the suction and discharge lines may escape, all of that gas is saved and put in the fuel gas header. Both the suction and discharge gates are closed and all of the gas between the two gates except a small amount flows into the fuel gas header through the bleeder line.

Where the suction and discharge lines to and from the compressors cross over, the suction lines have been laid two feet below the discharge lines. This prevents the discharge gas with its high temperature from heating the cooler gas coming in through the suction lines. To prevent the suction lines from putting too severe a strain on their connection each of such lines is strapped down to concrete pedestals in the basement. All of the bends in the discharge lines subject to severe strain are blocked with concrete.

Natural lighting of the station interior and the basement is amply cared for as may be seen by a glance at the photograph of the building. To improve this for cloudy days the interior is painted egg shell white and the machinery has been painted with green enamel. All of the piping has been painted with aluminum paint and each line is identified with stencil lettering. The out-

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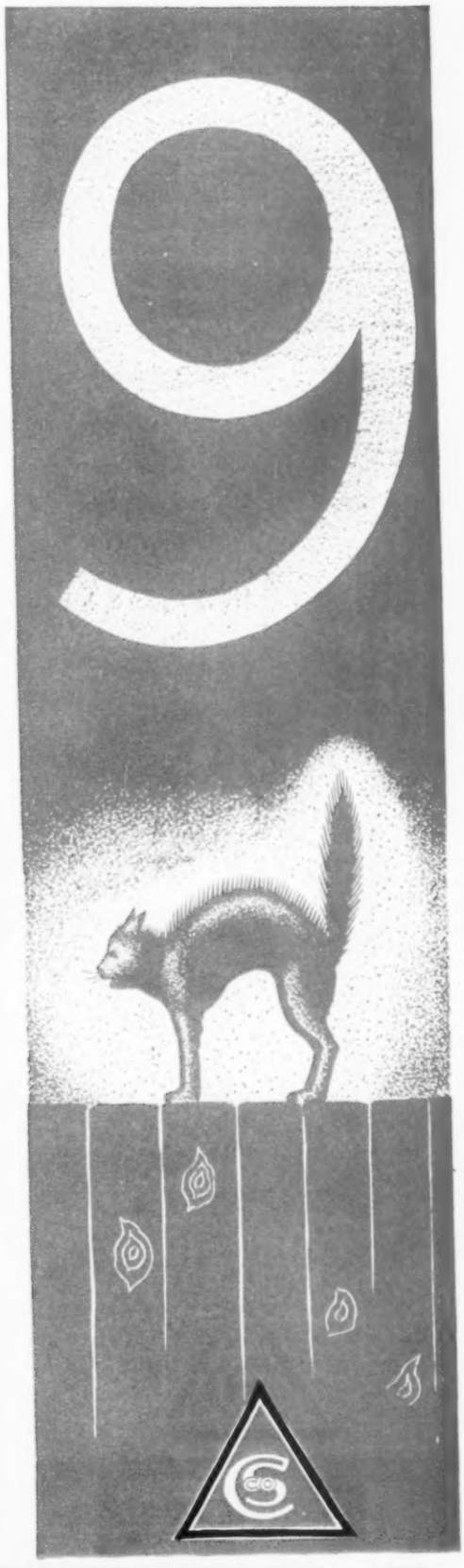

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2. Specially laid and constructed for catline use.
3. Each End whipped; will not fray out and unstrand.
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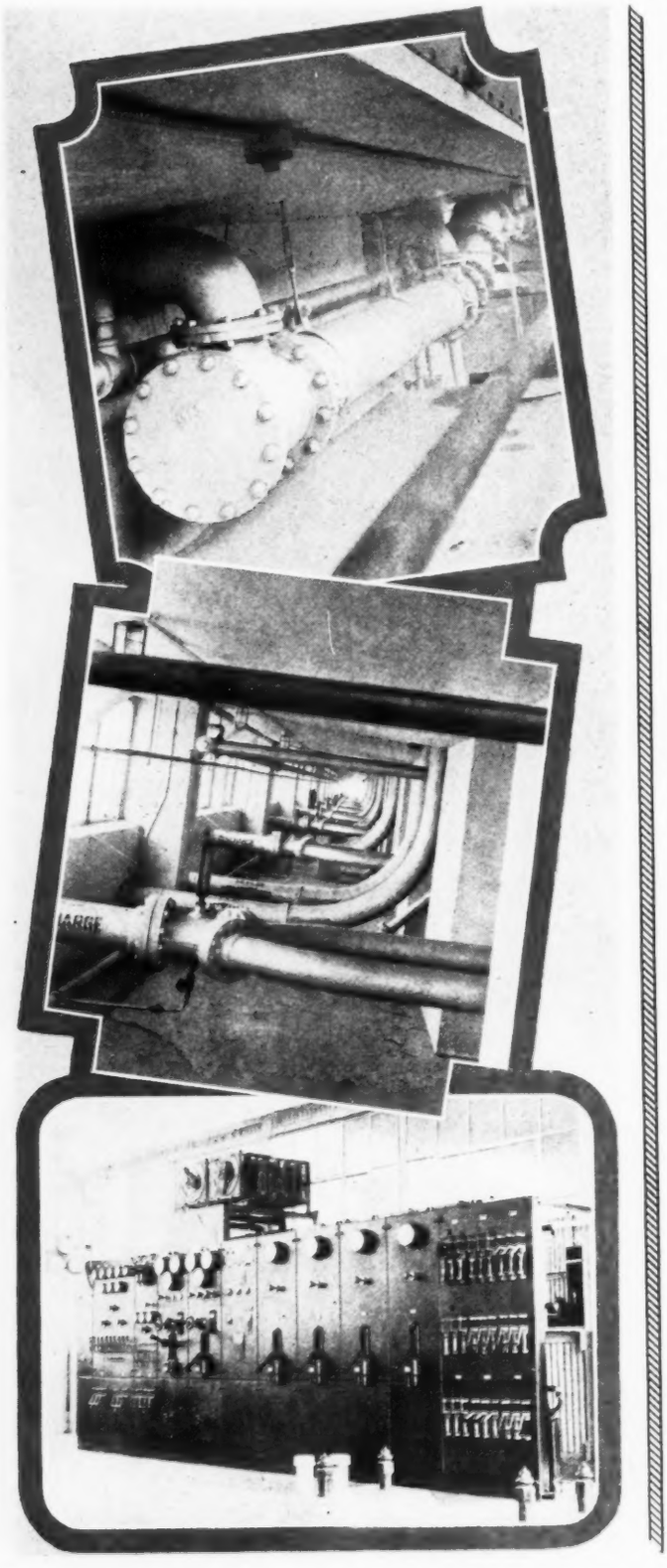
side of the station is painted pearl grey and the roof dark green, and all outside piping is aluminum coated.

The interior of the building is lighted with 33 500-watt lamps in white porcelain reflectors. A separate and emergency lighting system has been installed and gets its current from storage batteries in the event of a failure of the main lighting system. Flood lights on the water tower provide lighting for the cooling and piping system.

Considerable attention has been given to the lubrication of the machinery and all bearing lubrication is cooled before it is pumped to the bearing surfaces under 10 pounds pressure. The oil gravitates from the engine to a settling tank in the basement. It is picked up by a pump and discharged into a filter with a cooling compartment and from there it is delivered by the pump back to the engine. In addition to filtering the lube oil it is batched through a centrifuge housed in the auxiliary building. Lines leading to a batch tank in the engine room run to and from the purifier, and periodically the lubricating oil is cleaned by this method.



Top to bottom—Exhaust piping. Suction and discharge lines on compressor side of station in basement. Station switchboard.

Water for cooling the engine jackets and discharge gas is flowed from three wells approximately 500 feet deep. Fuel gas, used before its pressure has been reduced, flows the wells and is returned to the fuel header. Over each well is an 84-foot tower on top of which is a combination flow head and separator. By having the high tower it is possible to flow the wells by gravity into the 200,000-gallon water tower and gravitate the cooling water to the after coolers.

The jacket water gravitates from the big tank to the cold water pit adjacent to the auxiliary building, from which it is picked up by the circulating pumps and sent to the engines. There is such an abundance of water that it is not recirculated. Instead the hot water flows into a hot well near the cold water pit, and that which is not used for heating the building flows into the river. The water flowing over the after coolers also gravitates into the river. The system is so arranged that the water may be recirculated if necessary.

Water for domestic use comes from another well pumped by an automatically controlled deep well turbine housed in a separate building. It discharges into a small tank located inside the big water tank and rests on three 12-inch I-beams in the bottom of the big tank.

Fuel gas for station use as well as for the cottages and buildings at the site, is metered at a regulator house between the main station building and auxiliary building. Fuel gas for the engines is measured separately and the metering and regulating system is built in duplicate.

The auxiliary plant is similar in construction to the main station building and is 60 feet wide and 52 feet long. It is divided into engine room, machine shop, small parts warehouse and plant superintendent's office. Two 250-horsepower, four-cylinder vertical gas engines directly connected to 175 K. W., 440-volt, 60-cycle generators with direct connected exciters generate power for the motor-driven pumps, power machinery in the shops and current for the lights.

The machine shop is equipped to make extensive repairs at Munce for the master station as well as for the company's numerous other stations. Equipment consists of a 26 by 18-inch lathe for machining pistons and other large engine parts, a 16 by 8 lathe for machining exhaust valves and smaller work, a 20-inch shaper, a 24-inch drill press and a two-horsepower tool grinder.

In addition to the several water mains scattered strategically over the grounds the plant fire-fighting equipment consists of portable foam generating engines, hand extinguishers and reels of fire hose. One of the several safety features is the system of breaking the ignition circuits to the engines. The engines are all on one circuit and circuit breakers are located on the walls of the interior of the engine room. In case of an emergency all that is necessary is to break the glass in the circuit breaker which will shut down every engine operating.

The measuring station at Munce is one of the largest if not the largest of its type of installation in the country. Seven producing companies entered into agreements to deliver a certain per cent of the gross amount delivered each day and at a specified point.

It was agreed the measuring station should be built on the site of Munce station and that orifice meters with flange connections should be the type of metering equipment, which made necessary two complete sets of meters as the purchasing company planned using check meters. Thus prior meters of the selling company were located on one side of the building and the secondary or check meters were located on the opposite side of the building.

The installation is 30 inches above the ground and has 100 feet of straight run of pipe, including metering flanges, between inlet and outlet gauges. It is built on concrete pedestals 30 feet apart and strapped to the concrete. The prior meters have 40 feet of straight pipe between the inlet gate and orifice flange and the check meters have the same amount of pipe between the first and second orifice flange with 20 feet of straight pipe between the check meters and outlet gates. In most instances the several feeder lines approach the installation of a 22½-degree riser, but in other cases where regulators are set within 50 feet of the inlet gate, the runs approach the inlet gate on the same level. Gas coming into the station passes through vertical liquid scrubbers. The setting is divided into 21 separate meter runs, comprised of three 12-inch runs, ten 8-inch and eight 6-inch runs.

The 96 by 20-foot corrugated sheet iron building with asbestos roof is built directly over the selling companies' orifice flanges. The building has a removable floor with no part touching the pipe. The purchasing company's meters are piped into the building and have 24 feet of half-inch pipe in each gauge line. There are 42 meters with a range of 100-inch differential and 500 pounds pressure. Each meter run is equipped with four thermometer wells, two on the inlet side or the high side of the straightening vane and two on the outlet side a few feet from the outlet gate. Two of these wells, one on each end of the meter run, accommodate a fully compensated, 0-150 degrees F., mercury-filled, temperature recorder. The remaining two wells are kept filled with mercury so that a check with an industrial thermometer may be taken any time during the day. The flow is corrected daily for temperature.

Specific gravity tests are taken semi-monthly by means of a gravity balance. Three concrete blocks, one in each end and one in the middle of the house, were built to accommodate the gravity apparatus to prevent vibration and resetting. A quarter-inch line, connecting all meter runs when necessary, is piped to the gravity blocks, making it possible to make a gravity test on all lines without moving the apparatus. The line is thoroughly blown out between tests.

Seventy-six gates went into the installation and all meter runs have been painted aluminum with the gates, flanges, and fittings painted black. The entire layout is welded construction with the exception of the screw orifice flanges. The gauges are set with the same spacing in the house and every feature throughout is symmetrical. A dispatcher's office was built in connection with the measuring station and a dispatcher is on duty at all times.

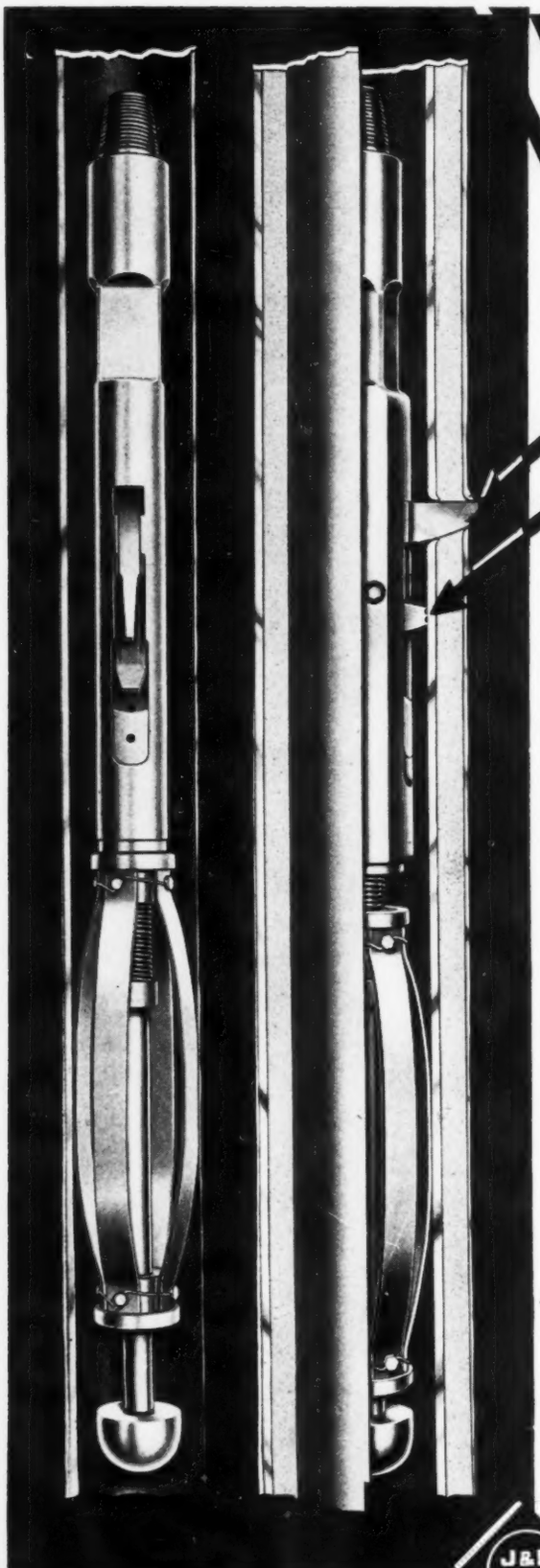
With such an elaborate layout it was considered an excellent investment to bring living conditions at the station on a parity with the general station design and thereby obtain a selected group of employes and reduce the labor turnover to a minimum. To this end excellent housing was provided and a clubhouse was added for the entertainment of the station personnel.

The dwellings consist of four six-room cottages and 12 five-room cottages. Each house has a garage and has modern conveniences. In addition there is a 10-room hotel.

The clubhouse building has a combination gymnasium and dance floor. It is equipped with various exercising devices and frequently the squared ring is used for a free-for-all whenever an ambitious group of the numerous negro youngsters in that section can be induced to swing wild rights and lefts. The building also has card rooms, a billiard room and a combination radio and victrola.

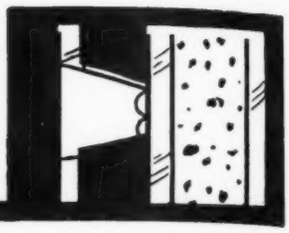
With these attractions, W. E. Nestor, superintendent of compressor stations, has little trouble in keeping an excellent crew and the station operating and maintained as desired.

Top to bottom—Circulating pumps and air compressors in auxiliary house. Storage between two engines; note hatch in ceiling. Exhaust stacks set on rollers.



WITH *this*

and this



» » » » BAASH-ROSS conquers the almost impossible task of perforating TWO strings of casing or a single string of casing backed with cement.

IT CAN BE DONE WITH A

BAASH-ROSS

LONG KNIFE PERFORATOR

AGAIN and again . . . the BAASH-ROSS Double String Finger Punch Perforator has performed the impossible! In every instance when this tool has been used, perforating has been accomplished with greater rapidity and consequent economy. Facts and data describing actual operations are available.

Note (illustration) the two knives . . . the shorter gripping the inner casing, while the extra long knife forces its way through two strings of casings or one string and cement. Because of the positive action of the knives . . . a good hole on every down stroke of the tool is certain. Knives are furnished in different sizes according to order.

BAASH-ROSS Long Knife Perforators are operated exclusively by BAASH-ROSS operators who have long records of successfully performing the most difficult perforating jobs. They are available upon demand. Sold outright only outside of U. S. A.

J&L PIPE B-R

BAASH-ROSS TOOL COMPANY
Box 1297 Arcade Station, Los Angeles, California

Send Bulletin 77—no charge—describing Baash-Ross Long Knife Perforator.

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When writing BAASH-ROSS TOOL CO. *please mention The Petroleum Engineer*

Two Important Factors in

Choosing Gasoline for Aircraft Engines

By E. R. IRWIN, *Asst. Aero. Chemist, U. S. Army Air Corps.*

IN choosing gasoline for aircraft engines there are two main factors to be considered, together with two other points which are less important only because present manufacturing methods are such that they are largely eliminated. The important factors are, of course, volatility and knock-rating; the other requirements being freedom from gumming and corrosive effects. The United States is fortunate in having very large supplies of gasolines from which fuels excelling in any one characteristic, without too great disadvantages in other respects, can be obtained.

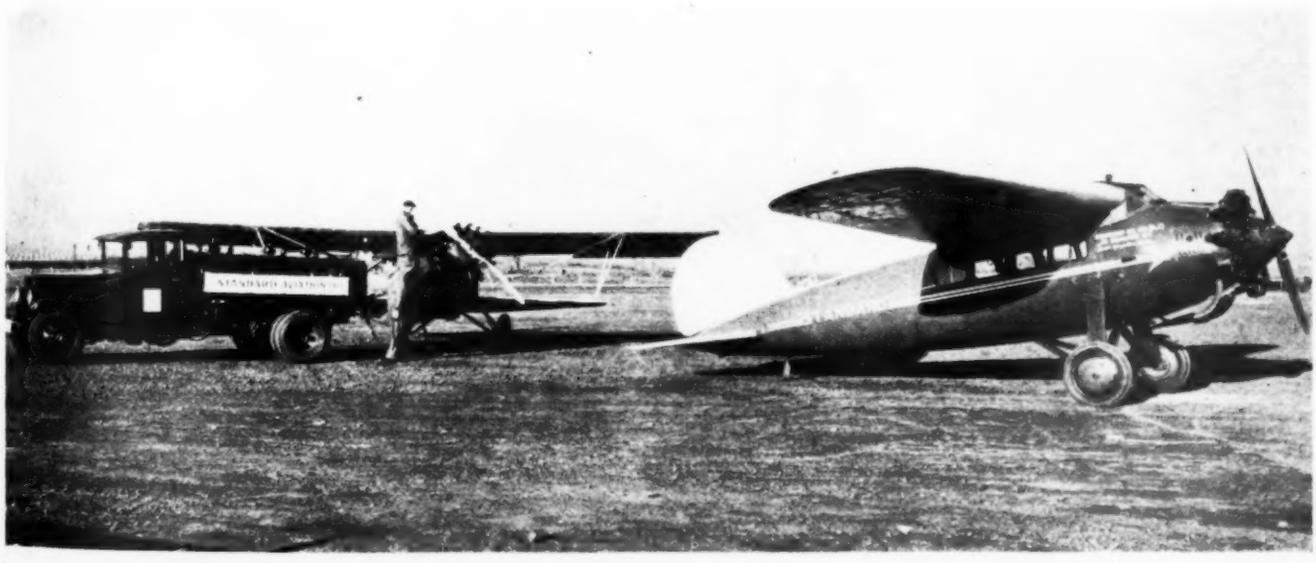
Volatility

To Dr. Brown at the University of Michigan and Dr. Bridgeman at the Bureau of Standards, among others, the oil industry is indebted for a great amount of careful and thorough work in connection with fuel volatility and its effect on engine performance. From the work of the various investigators, it is apparent that the simple and inexpensive A. S. T. M. (Engler) distillation test furnishes us with sufficient data to specify it as our volatility measurement. The 90 per cent point and the 10 per cent point, respectively, corrected for loss, show us the dew point and the bubble point of the fuel under examination. The loss shows whether or not there is an excessive amount of light ends and the end point indicates appreciable amounts of heavy ends, if present.

The highly volatile gasolines have not as great a heat value as the less volatile gasolines and if figured on a basis of B. T. U. per gallon the difference is appreciable. However, the conventional aircraft engine needs great volatility for efficient distribution and this, together with the fact that slightly better knock value normally accompanies high volatility, would indicate that the more volatile fuels are desirable. When it is considered that an automobile at 50 miles per hour uses about 3 gallons of gas per hour while the aircraft engine uses 30 gallons per hour to develop only 400 horsepower it is apparent that a fuel considerably more volatile must be used in the aircraft engine if equivalent distribution is to be obtained. The average 90 per cent points of more than 100 aviation gasolines examined at Wright Field was about 140 degrees C., while the 10 per cent points averaged 67 degrees C. It is believed that a somewhat more volatile fuel would be desirable, although no great difficulty is experienced with this range.

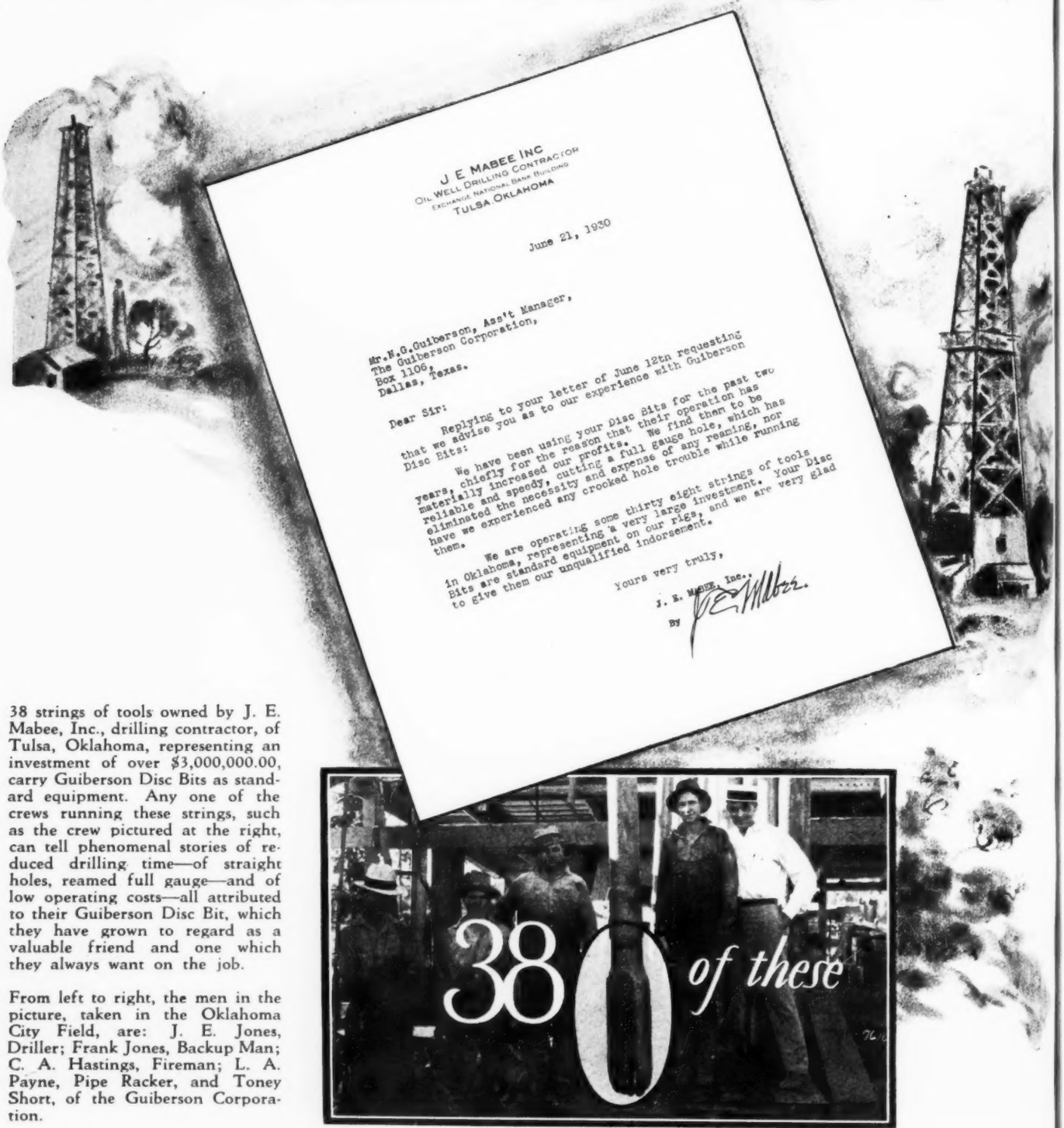
The 10 per cent point should be as low as possible, without introducing vapor lock, in order to facilitate starting. For military planes operating at high altitudes the corrected 10 per cent point minimum avoiding vapor lock is believed to be about 60 degrees C. For commercial flying, due to the lower ceiling and less full-throttle operation, a lower 10 per cent point, probably as low as 50 degrees C., is permissible. These values are only average as the installation of the fuel system influences vapor lock greatly.

While a practical estimate of the tendency to vapor lock can be obtained from the "10 per cent minus loss" or "10 per cent evaporated" point on the A. S. T. M. distillation curve a more accurate estimate can be obtained by determination of the vapor pressure of the fuel. The average vapor pressure of domestic aviation gasoline not blended with natural gasoline is about 5.5 pounds at 100 degrees F., determined by the Ried apparatus. With such fuel vapor lock is not encountered. With a more volatile fuel (corrected 10 per cent point, 61 degrees C.; 90 per cent point, 106 degrees C.) showing a vapor pressure of eight pounds at 100 degrees F., considerable difficulty which could only be explained by vapor locking has been encountered. It is obvious, therefore, that in order to make use of the highly volatile fuels some attention must be paid to the design of the fuel system. The author can see no reason



Fueling An Airplane in the Southwest.

The WORLD'S *Drilling Contractor* GUIBERSON


J E MABEE INC
OIL WELL DRILLING CONTRACTOR
EXCHANGE NATIONAL BANK BUILDING
TULSA OKLAHOMA
June 21, 1930
Mr.N.G.Guiberson, Ass't Manager,
The Guiberson Corporation,
Box 1106,
Dallas, Texas.
Dear Sir:
Replying to your letter of June 12th requesting that we advise you as to our experience with Guiberson Disc Bits:
We have been using your Disc Bits for the past two years, chiefly for the reason that their operation has materially increased our profits. We find them to be reliable and speedy, cutting a full gauge hole, which has eliminated the necessity and expense of any reaming, nor have we experienced any crooked hole trouble while running them.
We are operating some thirty eight strings of tools in Oklahoma, representing a very large investment. Your Disc Bits are standard equipment on our rigs, and we are very glad to give them our unqualified indorsement.
Yours very truly,
J. E. Mabee, Inc.,
By
38 of these

38 strings of tools owned by J. E. Mabee, Inc., drilling contractor, of Tulsa, Oklahoma, representing an investment of over $3,000,000.00, carry Guiberson Disc Bits as standard equipment. Any one of the crews running these strings, such as the crew pictured at the right, can tell phenomenal stories of reduced drilling time—of straight holes, reamed full gauge—and of low operating costs—all attributed to their Guiberson Disc Bit, which they have grown to regard as a valuable friend and one which they always want on the job.

From left to right, the men in the picture, taken in the Oklahoma City Field, are: J. E. Jones, Driller; Frank Jones, Backup Man; C. A. Hastings, Fireman; L. A. Payne, Pipe Racker, and Toney Short, of the Guiberson Corporation.

When writing THE GUIBERSON CORP. *please mention The Petroleum Engineer*

LARGEST *uses exclusively* DISC BITS

J. E. MABEE, OF TULSA, OKLAHOMA, is recognized without a rival as the world's largest drilling contractor. This position signifies leadership in a business which is noted for hardships—where keen judgment and correct decisions are the essence of success. Ten years of exemplary operations have brought J. E. Mabee, Inc., from a modest, one-rig beginning to a present day organization owning thirty-eight strings of tools representing an investment of over $3,000,000.00.

Guiberson Four-Disc Reaming Rotary Bits are standard equipment with these thirty-eight strings. This means that the income producing medium, or in other words, the thing that does the work for an investment of $3,000,000.00 is a Guiberson Disc Bit. Considering that the Guiberson Disc Bit is thus depended upon throughout the organization—the fact must be regarded as an indication of superb confidence.

But this confidence did not come before a trial. J. E. Mabee watched the Guiberson Disc Bit perform. He noted its remarkable speed, its full-gauged, reaming descent, its straight hole drilling—and then last, but most important of all, he summed up its cost of operation and selected it because it cut down his expenses and, as he says in his letter, "Materially increased our profits."

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GUIBERSON
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why the fuel described above could not be used very satisfactorily in a properly designed system, but with the equipment now in use by the Air Corps it was very troublesome. For the present the Air Corps desires gasoline with a Ried vapor pressure of not more than 6.5 pounds at 100 degrees F. A little difficulty in starting engines is much less undesirable than vapor lock.

In order to avoid vapor lock the fuel pump should be below the tank, the lines should be as straight as possible and of sufficient capacity to easily supply the carburetor, and, most important, the amount of heat absorbed from the engine should not be excessive. If these factors were considered in building and installing engines, more volatile fuels could be safely used, with easier starting and better performance resulting.

Knock Rating

Detonation robs the engine of power and life and the operator of the comfort and confidence obtained from smooth and powerful performance. Serious in the past few years, it will become more so as inevitably as we insist on bigger and more powerful and more efficient engines. The perfect solution is yet to be found.

A very brief survey of the advantages and weaknesses of the most important means of reducing detonation follows:

(1) Tetra-Ethyl Lead: Requires special steel for valves, valve seats and exhaust stacks. Applicable to all types of fuels and engines. Plentiful and widely distributed.

(2) Benzol and similar aromatics: Supply limited. Lose value as temperature rises above normal water-cooled conditions. No corrosion difficulties if properly refined.

(3) Alcohol: Must be practically free from water to be miscible with gasoline and will separate if water is picked up in storage or use. Low heat value. Could probably be produced very cheaply from otherwise practically valueless materials if sufficient demand were developed and, therefore, economically advantageous.

(4) Cracked gasolines: Lose value at high temperatures. If not carefully refined develop gumming properties. Do not add to the cost of the fuel.

It is believed that the best solution of detonation problems at present is by the use of a selected straight run gas of good relative anti-knock value with a moderate amount of tetra-ethyl lead for hot running engines, while a carefully refined cracked gasoline plus natural gasoline, if practical, to increase volatility and reduce gum formation, will avoid the cost and corrosion difficulties of lead and should be satisfactory in the cooler types of engines.

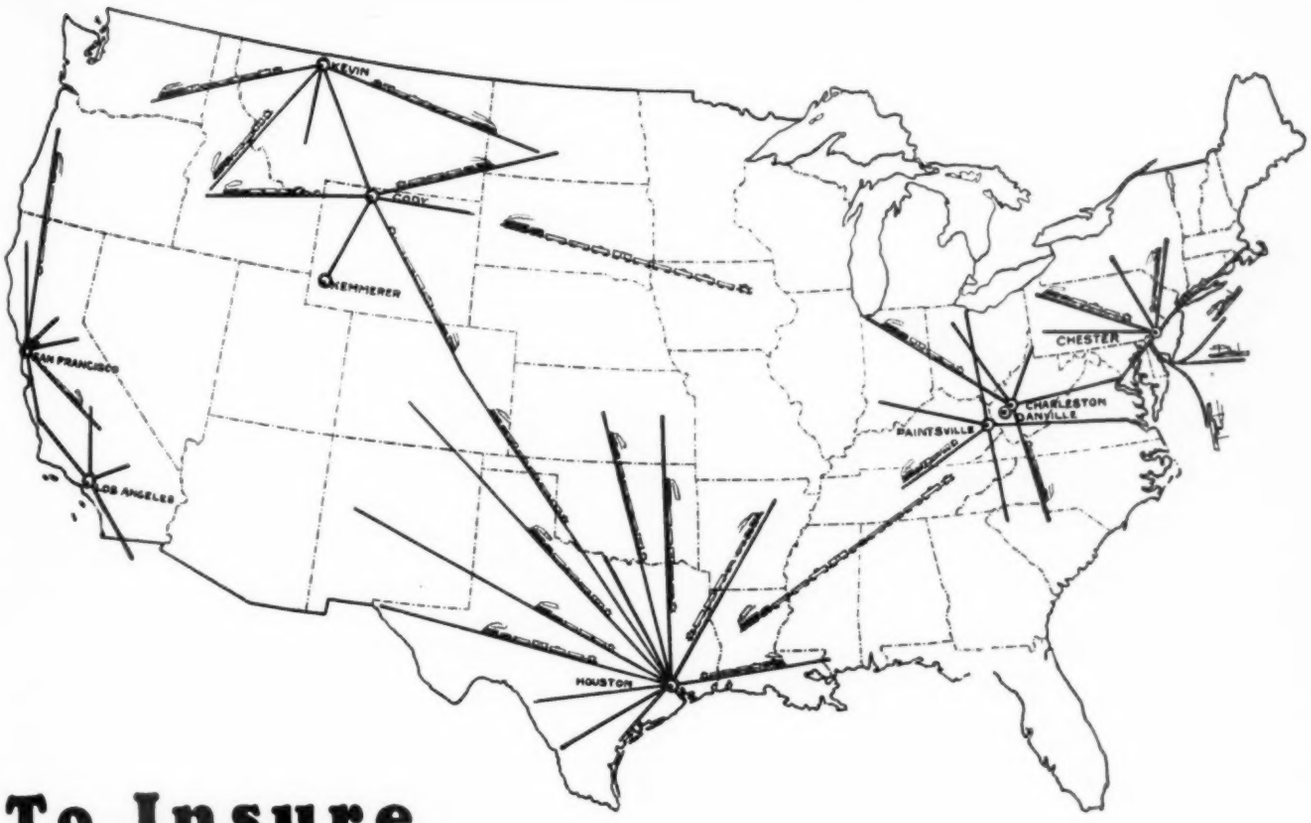
The ideal gasoline should be saturated and should contain a large proportion of napthene or iso-paraffin hydrocarbons. The potential production of power alcohol is a possibility which may be developed whenever gasoline becomes limited in quantity.

A large amount of testing of various anti-knock fuels at cooling liquid temperatures from 180 degrees F. to 350 degrees F. in an engine very similar to the Series 30 Ethyl Gasoline engine has been done at Wright Field during the past two years under the direction of Mr. S. D. Heron. This work shows that the relative value of the various anti-knock fuels is influenced very strongly by the temperature of the cooling liquid. Improperly designed water-cooled cylinders which permit hot spots might be as bad, or worse, in producing detonation. Gasolines which owe their resistance to detonation to the presence of aromatic or cracked hydrocarbons lose their value at high temperatures very rapidly compared to gasolines which are largely saturated. It is obvious that the conditions of test in the laboratory engine should simulate as nearly as possible, particularly in temperature, the engine in which the fuel is to be used. It is also found that the saturated gasolines are much more influenced by the addition of tetra-ethyl lead than the aromatic or cracked fuels. This work has been described in detail in a paper presented by Mr. Heron at the recent annual meeting of the Aeronautical Section of the A. S. M. E.

Gumming

While the development of the cracking processes for the conversion of heavy oils to gasoline was a contribution to industrial progress comparable only to the development of the gasoline engine itself, it is unfortunate that cracked gasolines may possibly produce gummy deposits in use and in storage than the straight-run or natural gasolines. It is found that vapor-phase cracked products are normally more subject to gumming than liquid-phase cracked, but in either case the fuel must be thoroughly

Airplane Used for Oil Company Work.



To Insure Prompt Service ...

The South Chester Tube Company has established distributing centers throughout the oil and gas fields of the United States. We carry large stocks at Houston, Texas; Thenard, California; Cody and Kemmerer, Wyoming; Kevin, Montana; Paintsville, Kentucky; Charleston and Danville, W. Virginia. From these strategic distributing centers we can provide prompt service to most points in the oil fields with casings and line pipe.

It has been our aim, for over thirty years, to produce casing and line pipe of the highest quality and workmanship—and at the same time maintain the quickest and best service possible to every customer.

We also specialize in double length line pipe of which the welds are as strong as the metal of the pipe.

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District Offices:

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CHESTER

STEEL CASING

SPECIALISTS IN CASING FOR DEEP WELL DRILLING

treated to remove the gum-forming constituents. Some samples of cracked gasolines examined at Wright Field showed only a reasonable amount of gum (glass dish) when received, but after a few months showed an increase of several hundred per cent in gum and a marked loss in knock rating. Tests should, therefore, be made to determine not only the amount of gum actually present, but also the amount likely to be formed in storage.

The copper dish test is by no means a perfect criterion of gumming, but a point often overlooked by its critics is that the test is an accelerated aging test due to the catalytic effect of the metal. In many cases the copper dish test is valuable in predicting storage effect, even though it was originated before the advent of cracked fuels to indicate corrosion and tarry impurities and does not have any value at all in determining the gum actually present in cracked gasoline at the time of test. The oxidation of a sample of fuel by air or oxygen, usually accompanied by heat and pressure, followed by a determination of the gum present by evaporation in an inert atmosphere or in a vacuum using a glass dish, has been suggested by many investigators. These methods show very valuable indications of possible gum formation in storage and it is expected that work now being done at the Bureau of Standards under direction of Dr. O. C. Bridgeman will result in correlating practical test with storage time.

It has been found that gasoline showing 15 mgm. of gum per 100 cc. (glass dish) at the time of use is satisfactory for aircraft use. It is probable that somewhat higher values can be used, but it is desirable to be on the safe side and as 15 mgm. seems to be a practical production value, it is recommended as the normal maximum, allowing for manufacturing deviations. An occasional batch that ran over this figure would probably do no harm, or better, could be sold as automobile gas, in which gum contents up to 50 mgm. are usually considered good.

The development of a cracking process which produced mainly saturated cyclic compounds would, in the light of present knowledge, be very desirable. Such a product should be stable in storage and should have a high natural knock rating, which would be maintained in hot running engines. In refining the present cracked gasolines, would it not be possible to hydrogenate the gum-forming unsaturated compounds by means of a suitable catalyst and convert them into stable anti-knock fuel instead of polymerizing or decomposing them and throwing them away? Natural gasoline is very stable and gum-free and of fair knock rating. It would seem, therefore, that the most desirable use of cracked and natural gasolines at present is to blend them for the production of anti-knock fuel. Due to the large amounts of low-boiling material, it would be necessary to use very thoroughly rectified natural gasoline, but the increasing market for the light ends as gaseous fuel should take care of these by-products.

Corrosion

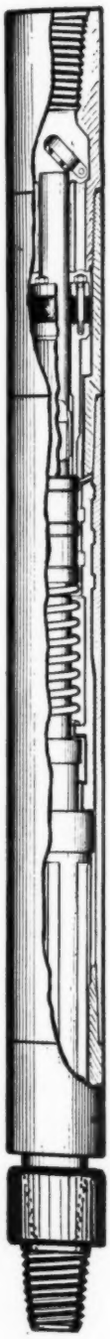
There are two kinds of corrosion encountered in service. The most common is attack of the storage tanks and fuel systems. Occasional cases of corrosion of cylinder barrels or parts of the engine inside the crankcase are experienced. It is commonly supposed that the latter type is a function of the total amount of sulphur in the fuel, but benzol blends containing only approximately 0.15 per cent sulphur, which is well below the supposed safe limits, have been found corrosive in service. There are three possible explanations: (1) the character of the sulfur compounds may influence engine corrosion; (2) some other elements are corrosive and have not yet been investigated; (3) 0.15 per cent sulfur is too much. In gasoline the present limits of 0.1 per cent are met without trouble and such gasoline will certainly give less corrosion due to its sulfur content than that caused by the three cc.'s of tetra-ethyl lead now used by the Air Corps. Although it may be quite true, as stated by reliable investigators, that almost any amount of sulfur is permissible except in cold weather, the author, in view of Air Corps experience, would prefer to adhere to the present standards.

The corrosion of storage tanks and fuel systems is caused by the gasoline directly in only very few cases of very poorly refined fuels. Most of this type of corrosion is caused by water which collects in the tanks by breathing and condensation. Water, which has been in contact with gasoline is usually, if not always, more corrosive than ordinary water in use. It is suggested that in addition to the usual copper strip test which will show whether or not the fuel itself is directly corrosive, it might be practical to make a corrosion test on the aqueous extract. It is practically impossible to make the light alloys, which are so extensively used in aircraft fuel systems, immune to corrosion by water. It is also impractical to eliminate completely the water. This type of corrosion is, therefore, not to be eliminated, but should be reduced as much as possible by the engine builders in choosing alloys as resistant to corrosion as possible or by using one of the several treatments available for reducing corrodibility and by the oil industry in refining their gasolines to remove the soluble organic acids, salts, sulfur compounds, or whatever material it may be that causes the acceleration of water corrosion.

Hangar of the Continental Oil Co. at Ponca City, Okla.

An Efficient Set
of
FISHING TOOLS
SHAFFER

Pump Trip Hydraulic Jar



The Shaffer Pump Trip Hydraulic Jar is extremely simple to operate, and exceptionally powerful in action. The driller lowers drill pipe to set—pulls up until he has the desired strain. Gets the blow by starting the pump which trips the jar. The driller then resets the jar by lowering drill pipe and proceeds as before. Thus with one man at the drawworks and another at the pump the jar is operated as fast as the drill pipe can be raised and lowered, using only the engine and brake and without throwing out the clutch or having to use the table to set or trip the jar. The jar has come out of the hole after 75 hours jarring in perfect condition. Circulation is maintained at all times except when jar is set for tripping. Is operated 2 to 3 strokes per minute. On account of its ease and speed of operation it is preferred by drillers and rapidly coming into use.

T. & T. Expanding Pin Tap

The Shaffer Expanding Pin Tap was designed, developed and manufactured in answer to a constant demand for a sturdy tool for backing off strings of drill pipe "stuck" in tight holes, with a tool-joint box or coupling "up."

In some of the smaller sizes of casing there is not sufficient clearance between the OD of the tool-joint and the ID of the casing to permit the use of an overshot or socket husky enough to withstand heavy abuse. A tap of the necessarily small diameter is too fragile for safety.

The Expanding Pin Top is made with a right-hand pin and screws on to right-hand box threads in the fish and runs on left-hand drill pipe. The tool is designed in such a way that this right-hand joint will not unscrew by left-hand rotation when an up strain is taken on the fishing string. The fish has to "left-hand" somewhere below the joint where the tool has locked up with it. Strength is built into the tool and the design allows ample clearance in the hole with no possibility of distorting the tool.

It has been successfully used on very tough jobs by many of the major oil companies, working to perfection left-handing 2⅞" drill pipe—(tool joint 3¾ OD) out of 4¾" casing—(4 1-32 ID).

Made for all Sizes Tool Joint Boxes
Patent No. 1687808. Other Patents Pending

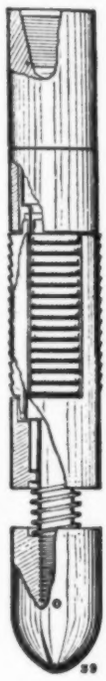
SHAFFER TOOL WORKS
BREA, CALIFORNIA

Patents Pending

TULSA—Fluid Packed Pump Co., Mid-Continent
HOUSTON—Robt. J. Miller Co. FOREIGN—Oilwell Supply Co.

T. and T. Safety
2 and 3 Slip Spear

On the three-slip T. and T. Safety Spear the slips are carried in a cage, which permits the three slips to move as a unit.



The cage rests on a coil spring which has sufficient tension to keep the slips elevated to the upper small end of the tapered mandrel—in the normal position for setting the spear.

The eccentrics on the mandrel are formed so that when the spear is set the slips tend to pull toward center. There is no tendency for them to slide to the release position while jarring.

The slips being normally located at the upper end of the mandrel, a slight rotation sets the spear in the fish, and full advantage is taken of the tapered mandrel in expanding the slips.

THE SPEAR OPERATES AS EFFICIENTLY WITH A SMALL LOOSE FISH AS WITH A HEAVY STUCK ONE.

The operating and releasing features are an integral part of the design, using the famous T. and T. patented eccentric mandrel.

T. and T. Releasing Socket

The patented T. and T. Safety Releasing socket has only two slips, the inside surface conforming to the fish (pipe or casing) and the outside surface fitted to a recess shaped on an eccentric. The socket is lowered on the drill pipe and forced down over the fish by the weight of the fishing string. A slight contact is maintained between the slips and the fish. By rotating the drill pipe the slips are closed tightly around the fish, gripping it firmly.

If, for any reason, the fish can be neither pulled nor unscrewed, by slacking off the strain and giving a slight turn in the reverse direction, the socket releases its grip on the fish, allowing the complete fishing string to be pulled out, leaving the hole clear for future operations. Takes hold by turning and pulling up. Releases by jarring down and turning in opposite direction.

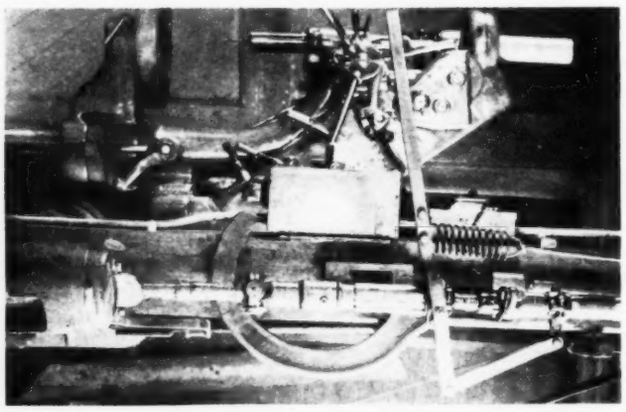
When writing SHAFFER TOOL WORKS *please mention The Petroleum Engineer*

Power Drill Utilized for

Grinding Valves at Pipe Line Stations

By CHARLES MITCHELL, *Chief Engineer,* Adding Station, Prairie Pipe Line Co.

At pipe line stations where a power drill has been installed in the station shop, the drill may be utilized to grind valves by gearing its speed down and making an expensive tool to fit the machine and valve. Such a method has its disadvantages, such as rotation in one direction at a comparatively high speed. This, however, is offset by elimination of the evils of grinding valves by hand, especially when it is difficult to get a crew member to give the required patience and skill to the job.



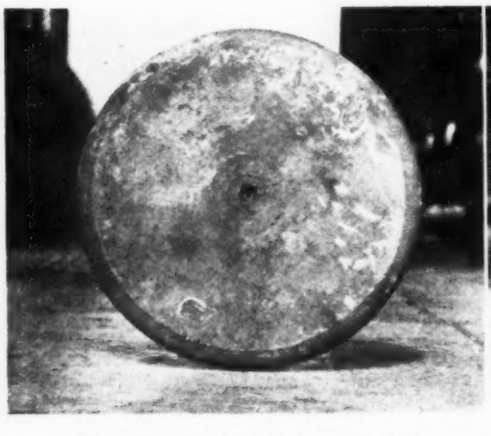
Power valve grinding device.

Prairie Pipe Line Co. built and equipped a small shop at its Adding station on the Panhandle and Mid-Continent line in Oklahoma, and part of the equipment includes a motor-driven silver drill which is used to grind valves. The drill is geared down to turn at the rate of 130 revolutions per minute, which is its slowest speed and the speed used to grind valves. A valve with pit holes as deep as one-thirty-second of an inch is ground and put in good shape in 30 minutes by this method.

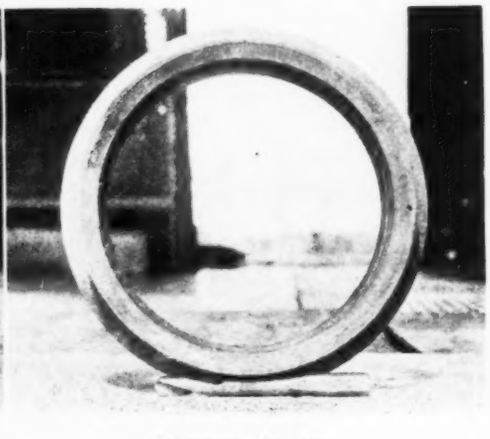
To utilize the drill for this purpose it is necessary to make a special tool from a three-inch length of three-quarter-inch cold rolled steel. The steel is split two inches down the center and spread out in an arch shape and the two ends tapered down until they are about three-sixteenths of an inch in diameter. When completed the two ends should be about one and one-half inches apart, approximately the proper distance apart in order to fit the holes in the valve. The valve casing is placed on the adjustable drill table and bolted to it. The specially-constructed tool is inserted in the drill chuck and valve and the valve made ready for grinding. Because of the continuous rotation in one direction, it is necessary to lift the valve from the seat frequently. At less frequent intervals during the operation the valve is raised and the seat cleaned with kerosene after using the compound. This is done to prevent the possibility of steel cuttings sticking to the seat. Possibly some of the cuttings may be sheared off during grinding and imbed themselves in the seat. By carefully following the grinding operation and frequently washing the seat with kerosene, the possibility of this trouble arising is virtually overcome. When the seats on the valve casing are worn too wide to insure efficient operation, they are dressed down with a carborundum stone. This stone is eight inches in diameter and one inch thick, or large enough to cover the valve casing. Grinding is done by using a small shaft, one end of which will fit in the drill chuck and the other end in the center of the circular stone.

The grinding operation is similar to that of grinding valves. The valve casing is bolted to the drill table and the grinding stone lowered into position to grind off the long bevel on the valve casing.

This method of grinding valves has been followed for some time with satisfactory results, and is speedier than grinding valves by hand. A grade "D" compound is used for grinding down the valve and grade "A" grinding compound is used to finish the work.



Valve ground and ready for reassembly.



Reground valve seat.

Where the Solution of "Cut Oil" Problems is *predetermined*

The PETRECO LABORATORY

is the ultimate development of years of intensive research in the treatment of crude oil emulsions. It is completely equipped with the most modern apparatus of every known type for this highly specialized field of endeavor.

Here Petreco engineers and technicians can determine exactly what is required in the successful treatment of any type of crude oil emulsion—and the exact results to be obtained.

Whatever difficulties your "cut oil" problems may seem to present, they can be rectified by Petreco. More than 20 years of successful performance are back of the Petreco Process. Examination of your "cut" oil in the Petreco Laboratory entails no obligation.

Every operating oil company should have a copy of our Bulletin No. 30-3—"The Petreco Process for the Electrical Dehydration of Crude Oil Emulsions." A copy will be mailed to you on request.

PETROLEUM RECTIFYING COMPANY of CALIFORNIA

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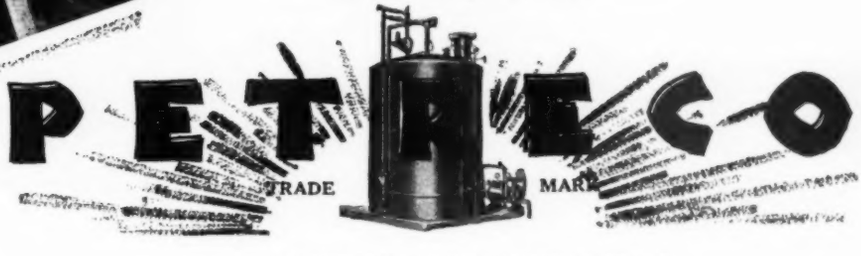

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Oklahoma City Operators Show

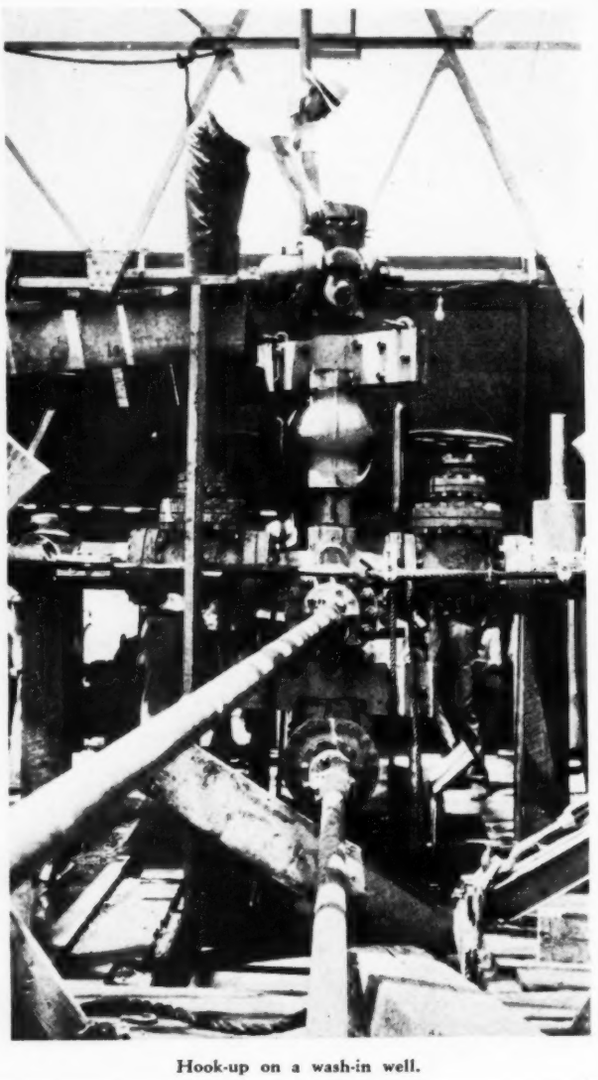
Much Interest *in* "Washing-In" Method

THE successful "washing-in" to completion of the Indian Territory Illuminating Oil Company's Mary Sudik No. 3, offset to the famous Mary Sudik wild well, has demonstrated the ability to finish, without loss of oil, wells in the highest pressure areas of Oklahoma City.

Since the first completion in the field by the "washing-in" method quite a number of tests have been brought into production by this method. These have shown that the oil and gas ratio has been reduced by this method over the old blowing-in method, previously used entirely throughout the field. Another important development is that none of the wells completed by washing-in have given any trouble.

There is a growing interest in the field at this time in this means of controlling the completion of these high-pressure producers and its use will doubtlessly increase. The slightly longer time required for the completion is offset by the method's safeness, lack of waste and control. Several companies, in addition to the Indian Territory Illuminating Oil Company, have completed wells by this method.

Indian Territory Illuminating Oil Company engineers bring their wells in against back pressure when using this method, which was described in the July issue of The Petroleum Engineer. The back pressure is secured by flowing the wells through beams, which are gradually opened up after the well has started flowing. This never permits the wells to gain velocity of any great force. History of wells completed in the south end of the field shows that when the flow is allowed to gain velocity the cutting action of the sand is terrific and has often resulted in wild wells when brought in by the old type method of blowing into the air.



Hook-up on a wash-in well.

Several wells in the Oklahoma City field have been brought in by the "washing-in" method that have differed in the kind of pipe used in the bottom of the hole. The hook-up on all of the wells has been practically the same otherwise. The first well brought in by "washing-in" at Oklahoma City used perforated pipe, but some of the recent completions have used screen pipe.

The Mary Sudik No. 3 had the casing landed two feet off bottom, at a depth of 6555 feet. The casing was five-inch O. D., weighing 15 pounds. The lower five joints were screen pipe. The body of the pipe had 72 holes, three-eighths inch diameter per linear foot. The screen was only ten one-thousandths of an inch mesh.

The smaller mesh in the screen further curtailed the amount of sand reaching the connections at the top of the hole, thereby reducing this hazard. It was evident that the sand screen materially reduced the gas-oil ratio as this well had a gas factor of approximately 1,000 cubic feet per barrel of oil, which is very good for wells in the Oklahoma City field.

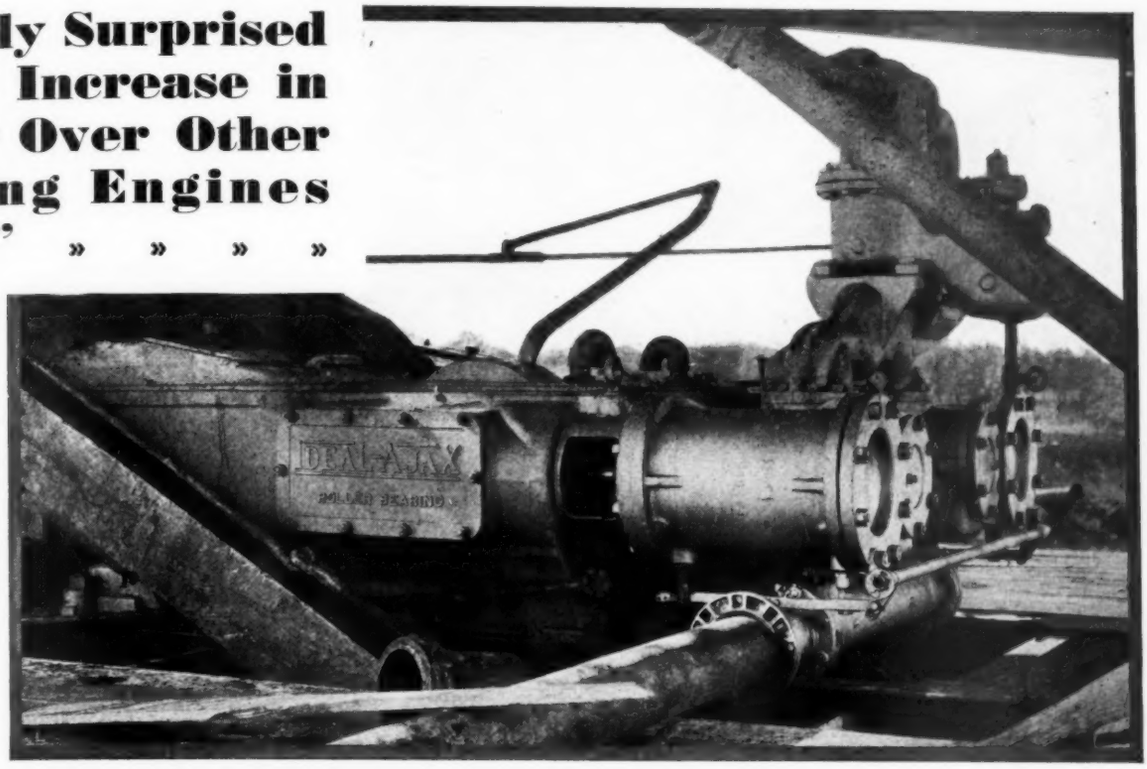
This well was flowed through two beams, which were gradually opened after the well commenced flowing. It started through a one-sixteenth inch beam. The first hour the well made 300 barrels of oil, against 200 pounds back pressure. At the end of five hours it was making 650 barrels of oil hourly, against 100 pounds back pressure. The last 13-hour gauge on the well was 8586 barrels of oil with 12,600,000 cubic feet of gas.

The Indian Territory Illuminating Oil Company recently "washed-in" its Clarence E. Trosper 2, NW. NE. Section 14-11-3w, using seven-inch drill pipe, open-ended, instead of running another string of casing. Fresh water is circulated down the drill pipe to wash the mud out of the hole between the drill pipe and the casing before the well is bailed in to produce through the casing without an additional flow string.

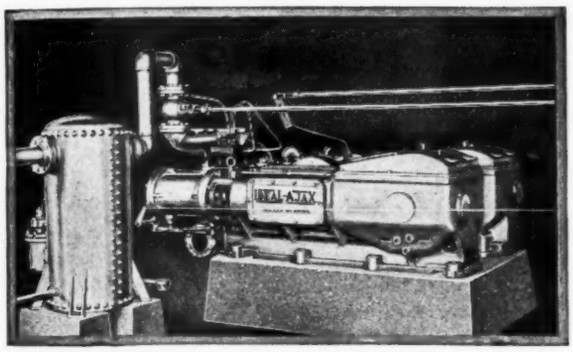
One of this company's wells has been brought into production by the "washing-in" method with a combination string of screen and perforated pipe.

The use of the "washing-in" method has been the foremost development in the completing of wells at Oklahoma City since its discovery. The reduction of the amount of sand cutting and reduction of the gas-oil ratio, which means a longer flowing life for the producers, are two major steps, while in addition the method does not damage adjoining property as did the old blowing-in method that sprayed oil over the countryside.

"Greatly Surprised at the Increase in Power Over Other Drilling Engines Used." » » » »



This engine at Oklahoma City drills a third deep well without being touched.



Latest Model IDEAL-AJAX Twin Roller Bearing Engine with Large Capacity Steam Separator.

THE IDEAL-AJAX roller bearing engine with locomotive type drain valves operated from the derrick not only gives new power but new speed.

There is time saved for condensation to be drained; no time lost in walking from derrick to open and close individual valves.

The headline is a quotation from a report this driller made after a third deep well had been drilled without engine repairs.

Out in California also, the new IDEAL-AJAX equipped with extra heavy Steam Separator is again making new records.

70% of the steam drilling of the world is performed by AJAX and IDEAL-AJAX, which carry fifty-three years' experience behind their development.

Ask the National Supply Company man for other records in these fields.

IDEAL-AJAX

ROLLER BEARING STEAM DRILLING ENGINES

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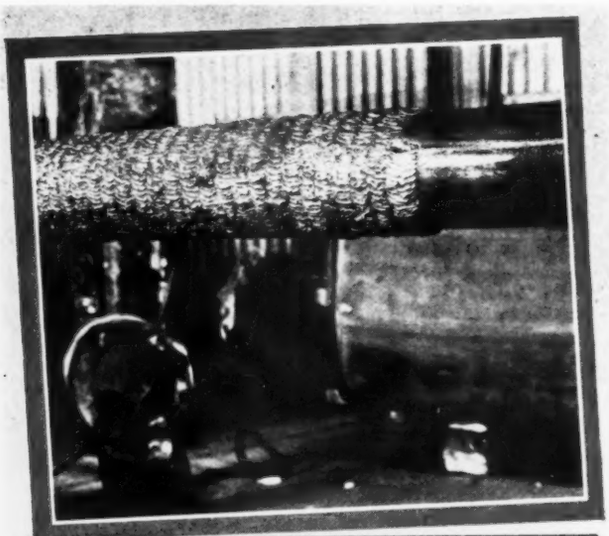
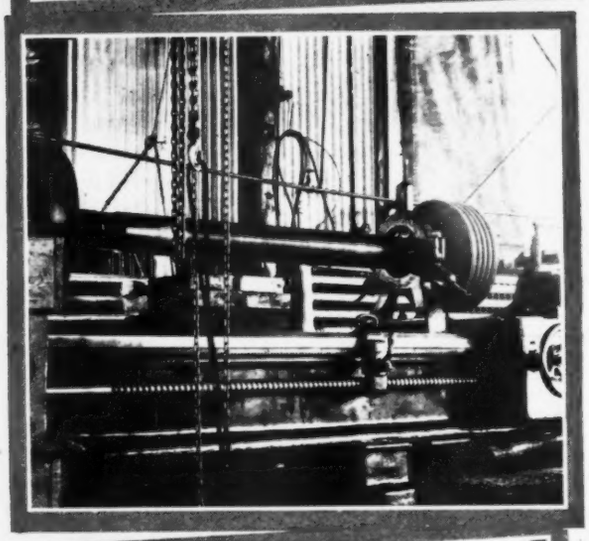
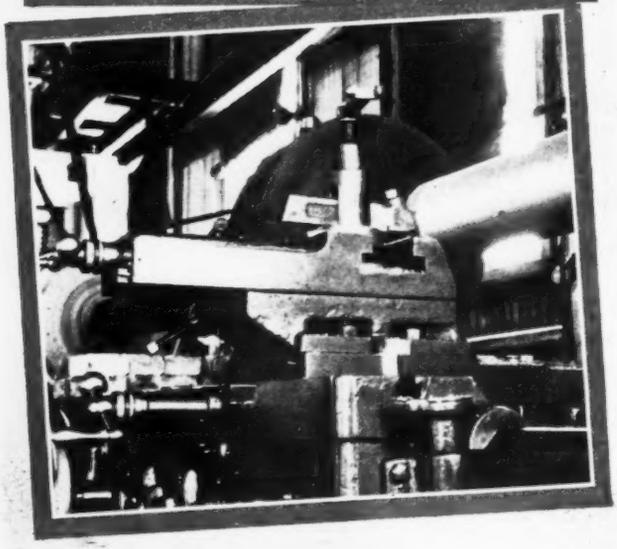
Rebuilding Power Rods By Welding







REBUILDING worn power rods for compressors by putting a rope weld around the rod and then turning it down in a lathe is a practice that has been followed successfully for several years by the Cities Service Gas Co. at its Tallant (Okla.) shops. The practice is not only successful from the standpoint of welding and machining, but is economical in maintenance charges. During the years this type of work has been done at Tallant, a limited amount of trouble has been experienced on account of defective machining or welding.

Considerable skill and patience on the part of the welders are required for the somewhat tedious work. The welding consumes the greatest amount of the time required for the job. When the rod is taken to the machine shop the most difficult phase of the work is straightening the warped steel. The work is slowed down, to an extent, because of the weight of the material to be worked with, but once the rod is straightened, relatively short time is required to turn it down to true.

Virtually all of such work is carried on during the summer months when gas compressor station engines are taken down for periodical inspections and overhauling. When a rod is found to be worn to the point requiring rebuilding it is loaded on a truck, transported to the shops and usually returned to the station by the time the crews are ready to reassemble the engine.

After reaching the shops the rods are first taken to the lathe and cut down one thirty-second of an inch on a side. This is done in order to permit the hard-surfacing welding metal to fuse with the rod metal at a point one thirty-second of an inch below the actual true or finished size of the rod. Inasmuch as the two ends on either side of the piston are not worn, it is relatively easy to machine down the proper depth. The cutting tool is started at a point where the rod is not worn and then cuts down the proper depth along the travel part of the rod.

After the rod is turned down it is moved to the welding shop and placed on horses. These are built with metal and welded rigid. Rollers are built on the horses and these permit the welder to sit on a bench and turn the rod as he welds a bead around it.

A 200-amp. arc welder is used to do all of the welding, and a five-thirty-seconds high carbon steel welding rod is used because it has been found to give the most satisfactory results for this type of work. The power rod is not braced during the welding operation and warping or kinking is cared for when the power rod is returned to the shop to be finished.

The welder starts working on one end of the rod and welds a continuous rope weld to the other end. When the work is finished the rod has the appearance of having a rope wound around it. While the weld is continuous, the operation is not. The welder works around the rod for an hour or so and stops. During this period he stops the work several times to change rods or take a brief rest.

The frequent rest periods not only give the welder a respite from a tedious task, but they also permit the metal to cool, which aids in preventing the rod from warping or

kinking too severely and possibly causing severe distortion. Welding time is retarded, too, because the welder is under instructions to give more attention toward obtaining a good weld throughout rather than make time. On the big job, such as a 6½-inch rod for a 14½-by-24 compressor, it requires about eight days to weld around one end of the rod. If it is necessary to weld around both ends, the time is doubled.

Best welding results are obtained when about a one-eighth-inch arc is held as nearly constant as possible. Competent welders are used on the job and they are men who usually give close attention to the details with the view of improving methods where possible.

Tearing down compressor for repair.

When the welding is finished the bead is approximately a quarter of an inch higher than the finished rod size or true. By having the weld extending up that height and fusing with the rod metal a thirty-second of an inch below true, the finishing job brings the rod true or finished size down to about the center of the rebuilding material. This is desired in order to bring the true to the heart of the weld.

When the welding operation is completed the rod is again taken to the machine shop, where the final work is done. Unless the rod is badly warped it is placed in the lathe and a slight cut is taken to smooth down the weld and make it easier to measure and straighten.

This phase of the work likewise requires care and skill. Locating the kinks is relatively easy. A straight-edge is used and the rod should line up with the two true ends which the machinist uses as a guide. Sometimes only one kink is found when the rod is first measured, but by the time the final operation is completed all will have been found.

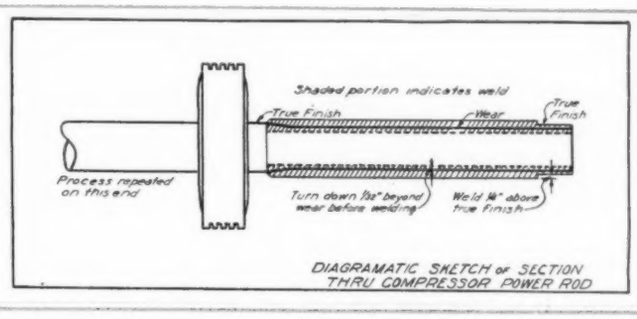
After a kink or warped place is located, the power rod is turned in the machine until the sag extends downward from the bottom of the rod. Gas torches are used to heat that section and an effort is made to concentrate the heat on the kink. It is left to the machinist's judgment as to when the rod is heated to the proper temperature. Ordinarily, when the metal takes on a cherry red hue, it is hot enough for the straightening operation.

Clamps are attached to the machine and fastened on the rod on either side of the kink. These are tightened down to a degree just prior to bending the metal. A screw jack is placed directly beneath the kink and this is used to slowly straighten the kink. In straightening the big rods the kink is pushed upward about one-eighth of an inch to allow for shrinkage of the metal when it cools. In most instances the pushing of the kink this much out of true is sufficient and when the metal cools it contracts to an approximately true condition.

Frequently the heating of the rod to straighten out a kink causes slighter kinks to approximately straighten themselves and, conversely, it sometimes causes slight kinks. This operation is repeated until the rod measures true. It is then allowed to cool before the final machining is started.

It requires approximately two days to turn down a rod and get it ready for shipment to the station from which it was reremoved. After it is finished it is greased to prevent rusting while in transit and wrapped to prevent the polished surface from being damaged.

Approximately 100 pounds of welding rods are required to build up one end of a 6½-inch rod for a large engine, and twice as much when it is necessary to rebuild both ends. Around 75 pounds of welding material is consumed in rebuilding the smaller jobs. These jobs likewise consume less welding time, which ranges between four and five days. Thus the shop is able to turn out a rebuilt power rod job at a cost of around $150.00 and at the same time get a job that is entirely satisfactory. A great many of the rebuilt rods have been in service a longer period than they were before rebuilding.


Shaded portion indicates weld
True Finish
Wear
True Finish
Process repeated on this end
Turn down 1/32" beyond wear before welding
Weld 1/8" above true Finish
DIAGRAMATIC SKETCH OF SECTION THRU COMPRESSOR POWER ROD

And while economizing, another saving was made in powering the generator for the welding work. This machine is a portable gasoline engine-driven generator. Inasmuch as the shops are located adjacent to a compressor station, it was decided to operate the engine on gas instead of gasoline. A tee connection was made and put on the intake riser above the carburetor and a valve put on the gas line leading to the engine. This permits the regulation of flow of gas to the engine and is used to control its speed. Gasoline is used to start the engine, but after it is turning over the gasoline is cut off and gas turned on. It operates with less noise and as smoothly as when operating on gasoline, and something like 33 per cent is being saved on motor fuel.

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McEVOY UNIVERSAL TUBING RETRACTOR

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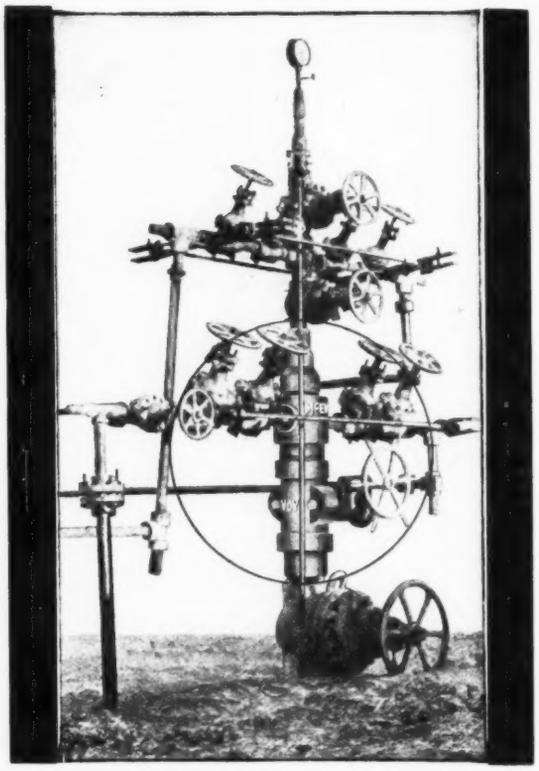
THE McEVOY UNIVERSAL TUBING RETRACTOR. . . . 1. Will permit separation of tubing sufficient to close master gate valve . . . . 2. Relieves Christmas Tree of all pressure while repairs are being made . . . . 3. Not necessary to loosen the down rods . . . 4. Can be operated in 30 seconds . . . 5. NOW BEING USED SUCCESSFULLY IN HIGH PRESSURE FIELDS.



The McEVOY UNIVERSAL TUBING RETRACTOR is shown in the circle in the picture above.

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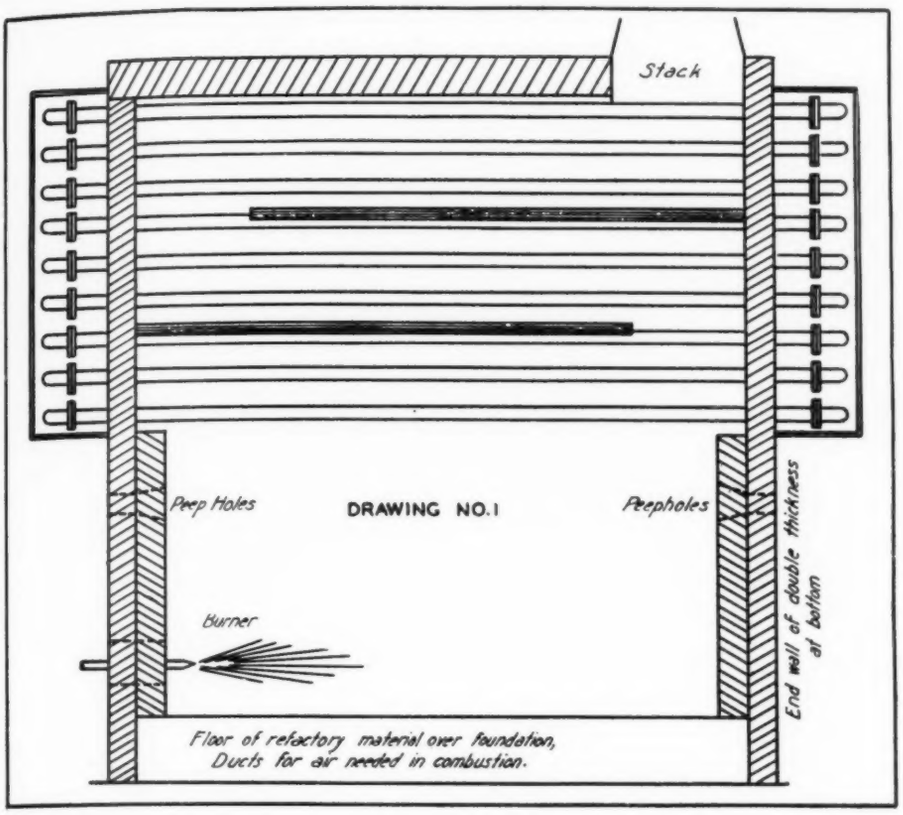

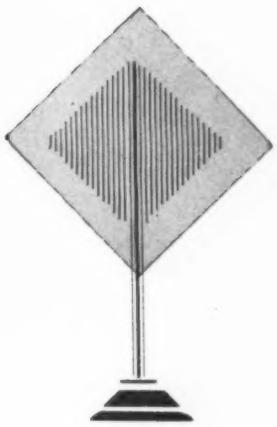

Developments in

Furnaces *for* Processing Oils

By **FRANK PRAEGER**[1]

TRENDS in use of furnaces for processing oils have produced various types of furnaces year by year that have tended to show higher rates of charge, and to promote efficiency in fuel consumption, in first cost (compared to capacity) and in bulk and ground area.

The old type of shell still has been quite thoroughly eliminated from all consideration as an efficient installation operating with a high co-efficient of heat transfer. The pipe or tube still is generally recognized as one of the best mediums for heating oils. This is true especially in cracking units and topping plants, but is also true in lubricating oil plants, whether for those producing neutral stocks under a sub-atmospheric pressure or for those producing the heavier residual stocks.

Among the types of tube stills adopted, the earliest after the shell still was the simple tube retort, relying chiefly on the transfer of heat by convection from the flue gases passing between tubes. Drawing No. 1 shows one of this type, with horizontal tubes separated into groups of rows by horizontal baffles that constantly reverse the flow of flue gases through and between the tubes. The baffles are often arranged to allow an increasingly narrow channel for the cooling flue gases.

A furnace of this type will transfer some five B.T.U. per hour per square foot per degree F. mean temperature difference. That is, such a furnace, having 90 tubes, each 16 feet long by 4 inches inside diameter by 4½ inches outside diameter will raise 125 barrels per hour of 32 degree gravity crude some 350 degrees in temperature. The 16-foot length is clear length within the furnace.

In the foregoing paragraph, and those following, the reader should bear in mind that the figures quoted are only comparative. They are based on one of the ordinary types of operation, and may be larger or smaller with changes in the operating procedure. An increase in the amount of fuel consumption or the excess air, a decrease in the viscosity of the charge or an increase in the amount of oil fed per hour through the tubes will increase the co-efficients greatly. Furthermore, even in the convection type furnaces there is a considerable radiation of heat to the exposed tubes, which varies with the furnace temperature according to the Stefan-Boltzmann Law.

Drawing No. 2 shows another type of convection furnace. The flue gases go straight through the tube bank in this case, at right angles to the axes of the tubes, and a high co-efficient of heat transfer is obtained by bringing the centers of tubes as close together as possible, thus limiting the free space through which the gases travel and forcing more molecules of hot gas to impinge on each tube. A simple convection furnace of this type will transfer some five B.T.U. per hour per square foot per degree mean temperature difference. On the basis of the same tubes as the furnace of Drawing No. 1, it will have the same capacity

[1] Alcorn Combustion Co.

Commercial Department

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and will avoid the undesirable radiant heat transfer at the point of maximum heat transfer by convection under the baffle opening.

There are numerous types of convection furnaces, but in general they are similar to one of the above-mentioned types, and their rates and co-efficients of heat transfer are very similar. It may be seen from Drawings No. 1 and 2 that if the tubes are placed closer together there will be a greater crowding of flue gases through the narrowed spaces between tubes and a greater transfer of heat from gases to tubes. Similarly, if more hot flue gas is produced (by burning more fuel or using more air for combustion) and run through the tube bank, there will be an increase in the co-efficient and so in the total of heat transferred. If the number of tubes is increased the co-efficient is not changed but the total amount of heat transferred to the tubes is increased.

All of these expedients tend to increase the draft loss through the tube bank, so that after a certain point the stack draft is insufficient to draw the flue gases through all obstructions, and an auxiliary hot-air fan is required to reinforce the stack draft. A method frequently used to increase the co-efficient of heat transfer in a convection type of tube still is to draw off a portion of the flue gases en route to the stack and recirculate them through the convection tube bank. This increases greatly the mass velocity of flue gases passing through the tubes and thus increases the co-efficient of heat transfer by convection. It is apt to result in a somewhat lower temperature of gases entering the tube bank (due to the lower temperature of the recirculated gas), but shows a net increase in the amount of heat transferred per hour.

Recirculation of flue gas will increase the amount of heat transferred per hour in furnaces similar to those of Drawings Nos. 1 and 2 by from 20 to 30 per cent, and will increase their throughput by a similar percentage.

To obtain high rates of heat transfer without encountering the difficulties outlined in the previous paragraphs, many refiners have been turning to the radiant heat furnace designs.

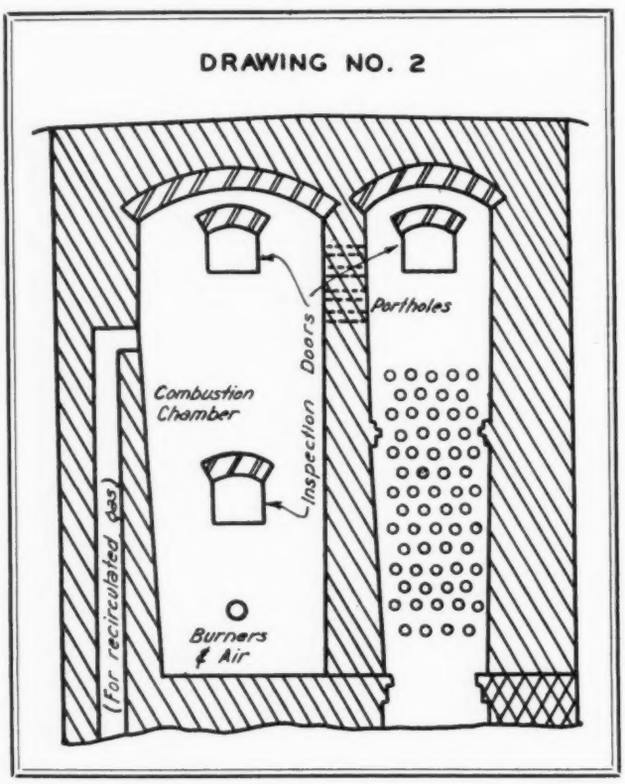
The radiant heat utilized comes either from the masonry (brick work, carborundum, etc.), or from the flame, incandescent particles in gases or the hot molecules of the heavier components of the flue gases and products of combustion. Furnaces utilize both types of radiation to a considerable extent, even though they specialize markedly in one or the other. Both cause high rates of heat transfer and permit increased throughputs in any process, with a decrease in tube requirements.

Drawing No. 3 shows a furnace designed to utilize radiant heat transfer of both types. The small convection section is intended to cool the outgoing flue gases and decrease the amount of heat lost when they enter the stack. It should be observed that there is some radiation to the tubes from the molecules and particles of the flue gases, but the majority of the heat transfer is by radiation from the masonry. It is necessary to control the transfer of heat by radiation, as the process is rapid, and excessive or uncontrolled radiation is apt to overheat certain parts of the retort.

The furnace shown is a "screened" radiant heat type. Its burners fire into firing tunnels, or "muffles", whose masonry is heated to a high temperature and radiates heat rapidly to the tubes above. The muffle may be built (both top and sides) of fire brick or tile. This type of furnace, with its screened radiation, allows high rates of heat transfer with relatively few tubes and provides an even radiation of heat to all tubes above the firing tunnels. It will give a co-efficient of heat transfer in the radiant heat sections ranging from 15 to 20 B.T.U. per hour per square foot per degree of mean temperature difference, depending upon the nature of the process and of the charging stock, which dictate to a large extent the temperatures used.

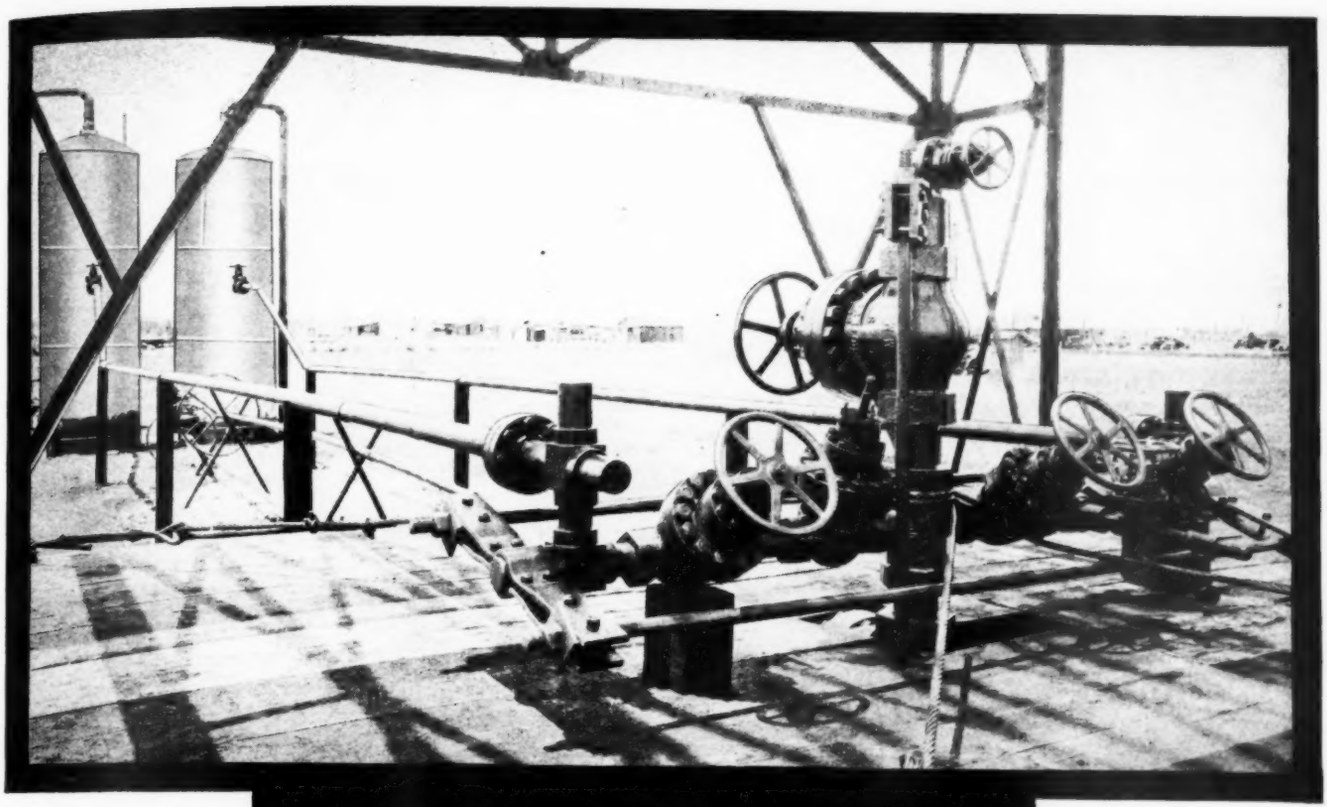
The type of furnaces transferring heat primarily by radiation has the additional advantage of requiring no high temperature in the flue gases immediately surrounding the tubes. When it is considered that, in the ordinary retort, temperatures of between 1300 and 1600 degrees F. are required, it is seen that furnaces may play a very important part in the maintenance as well as the replacement of cracking tubes. It may be taken that ordinarily, in a cracking process, the temperature of the outside surfaces of tubes may rise as high as 1250 degrees F. If in addition flue gases at a temperature of 1600 degrees F. are in contact with these tubes, there is a strong possibility of oxidation, or nitrogenation, or of actual softening of the tubes. Therefore, any method of heat transfer that eliminates the contact of flue gases at excessive temperatures with the tubes would promote longer tube life.

DRAWING NO. 2



The economical use of any of these furnaces with high rates of heat transfer requires care and attention to proper operation. For instance, a marked decrease in the rate of flow of the oil charge through the tubes will increase the thickness of the stationary film of oil in contact with the metal, which will decrease the rate of transfer of heat from the tube to the oil, raise the temperature of the tube (sometimes to a dangerous point) and cause partial cracking of the charge, with an excessive deposition of coke. Improper firing of one or more of the burners, or not firing a burner, will often cause serious furnace trouble. Allowing little defects to remain unrepaired, or refractory debris to accumulate in the tube banks, can easily bring about serious troubles in a furnace.

Further, care must be shown in the design of a furnace for its expected use. The quantity, nature, gravity and viscosity of the charge must be allowed for, and the temperature range and pressure conditions taken into account. In other words, the whole operation of the unit must be



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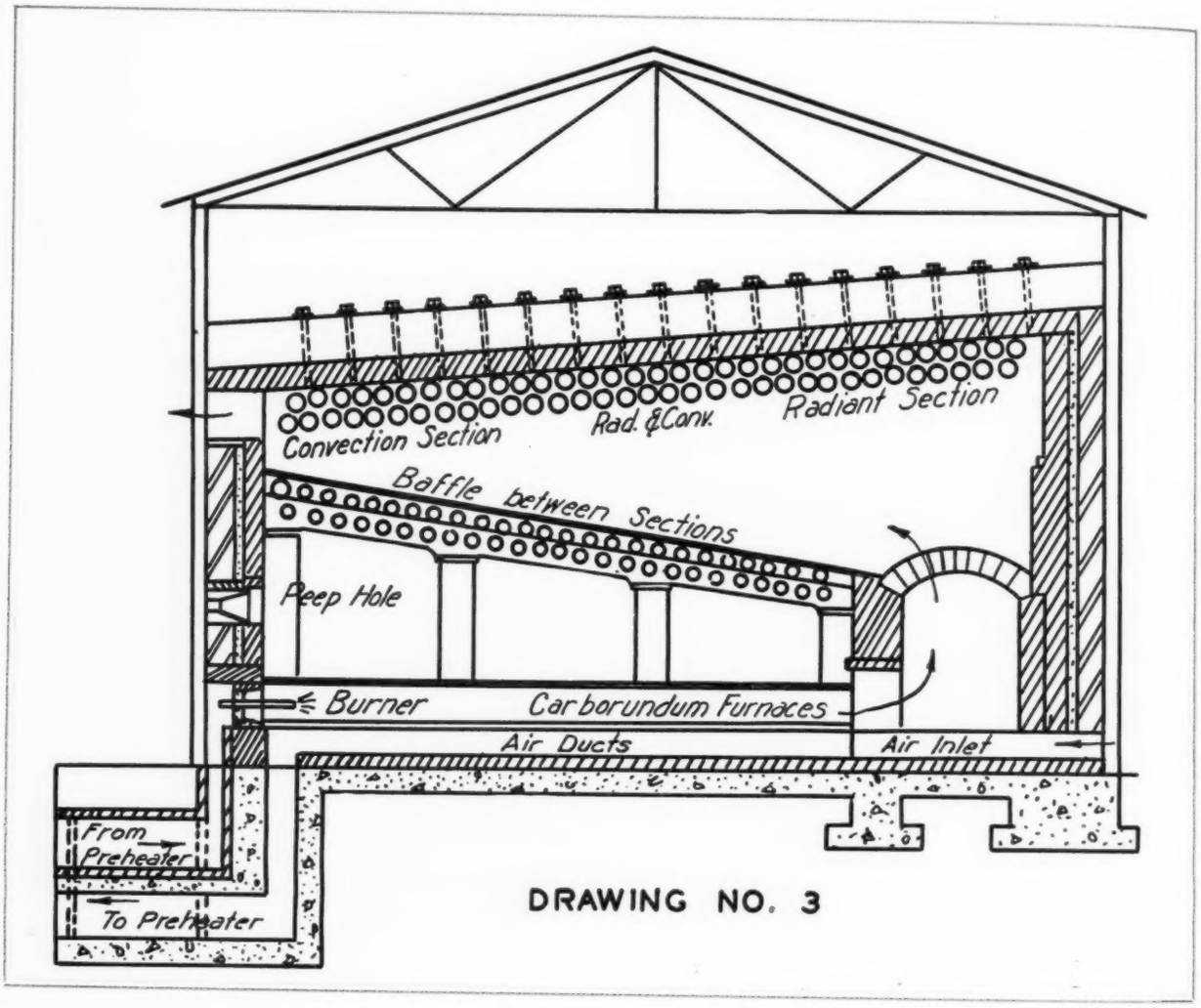
foreseen and allowances made for everything in the design of the furnace. Any considerable change in such conditions may be expected to effect a similar change in the results obtained from the furnace, and too frequently a deviation in the conditions results adversely. This appears obvious, but seemingly it is overlooked quite often. Insufficient heat transfer, tube damage and even deterioration of furnace masonry are the price paid for making such changes without a careful preliminary study of the effects.

For these reasons, if an efficient furnace is desired, the exact work expected of it should be determined; it should be designed by an experienced and capable engineer, and after completion it should not be called upon to face an entirely new set of conditions. A furnace may be designed to cover widely varying operating conditions if the variations are allowed for beforehand, but sometimes this causes a slight increase in the first cost.

Up-to-date refiners realize these facts, and are turning in increasing numbers to the modern types of furnace, with their high co-efficients of heat transfer, relatively low first costs and elasticity in the face of varying operating conditions. They are also analyzing more carefully the work expected of each furnace and are demanding more careful and efficient design.



DRAWING NO. 3

Gasoline Bids to Be Asked by War Department

THE Air Corps of the War Department, with headquarters at the Wright Field, Dayton, Ohio, will shortly request bids for Fighting Grade Anti-Knock Gasoline to Specification Y-3557, according to R. M. Jones, Major, Air Corps, and Contracting Officers.

The present intention is to divide the country into zones, probably not in excess of six zones. Bids will be made on a basis of supplying a complete zone rather than any part thereof. In order to prevent delays due to inspection by the Material Division of each tank car before it is discharged, bidders will be bonded to deliver material in accordance with specifications, and will furnish a certified copy of tests made in accordance with Y-3557 specifications on each mix. The Material Division will, at the discretion of its inspectors, select samples upon certain deliveries for the purpose of checking the contractors' test results. Rejections of gasoline giving unsatisfactory performance will be based on Material Division tests.

"Protecting Against the » » » » » » » » Hazard of Tank Cleaning"

By C. L. HIGHTOWER*

THE work of cleaning tanks and tank cars offers many hazards, varied according to the product stored or transported and the conditions under which the actual cleaning operations are carried on. There are, however, two major hazards to be guarded against which are common to all cleaning operations where vessels previously containing petroleum or its products are concerned. They are: explosions and fires, and asphyxiation of the workmen.

The past few years have witnessed remarkable progress in the development of safe practices in this work and the methods that were, a few years ago, largely based on guess work have been replaced by definite and practical plans of protection. The dangers have not been entirely removed by the provision of testing apparatus and protective devices as the human element is, and will continue to be the controlling factor. The equipment available is beneficial only to the extent that it is intelligently used and the numerous accidents which occur each year in tank cleaning work evidences the need for an intensive educational campaign on the part of supervisors as well as workmen.

For a long time, gases and vapors emanating from petroleum and its products have been known to be injurious when inhaled in high enough concentrations and the possibility of explosions and fires inside vessels formerly containing crudes or lighter products has been equally as well recognized, but it is only in recent years that instruments have been developed for the detection of gas conditions in an accurate and practical manner.

Since vapors are most often detectable by odor, the sense of smell was largely depended on for determining dangerous quantities — either explosive or asphyxiating.

The practice of placing a lighted torch inside a vessel, after it had been steamed and aired, to determine whether or not it was gas free is known to have been followed. Most often, however, a vessel was washed, steamed thoroughly and left open for a period of thirty-six to forty-eight hours to permit the circulation of air through it, after which it was assumed to be safe to permit workmen to enter. Some companies still work on this basis, having proved to their own satisfaction that a certain period of steaming and airing will rid a vessel of dangerous vapor mixtures. They fail to take into consideration, however, that some tanks require more steaming than others and that in stirring up sediment accumulations in a tank, quantities of vapors are released.

The more progressive executive in refinery or field now demands that the supervisor in charge of cleaning or repair work have a thorough knowledge of gas conditions in a tank and insists on the use of

Top to bottom, Upper left and right—Fully equipped with mask, life belt and line and ready to enter the tank. Entering the tank through the manhole plate opening. The operator of the blower remains in a position where he can see the man in the tank and keeps the life line within easy reach.

* Safety Director Texas Pacific Coal & Oil Co.

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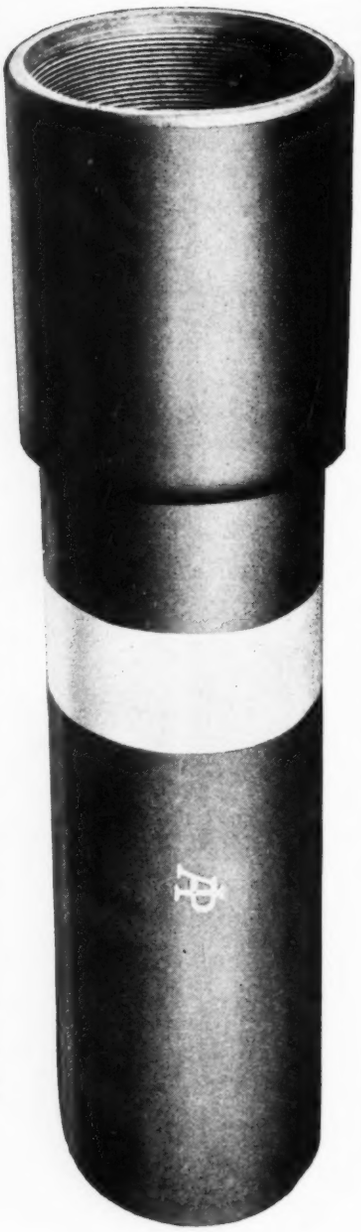

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indicators or vapor tests to insure the safety of the men.

The first operation in cleaning a tank is to drain or pump all possible fluids out. Water should then be pumped in and free oil floated and pumped off. The tank is then ready to be steamed. The top hatch should be opened and steam introduced from the bottom. The interior of the tank should be heated to 170 degrees and the length of time steaming should be continued depends on size of tank, kind of product previously contained and the volume of steam introduced. No time limit should be set and each tank should be considered individually.

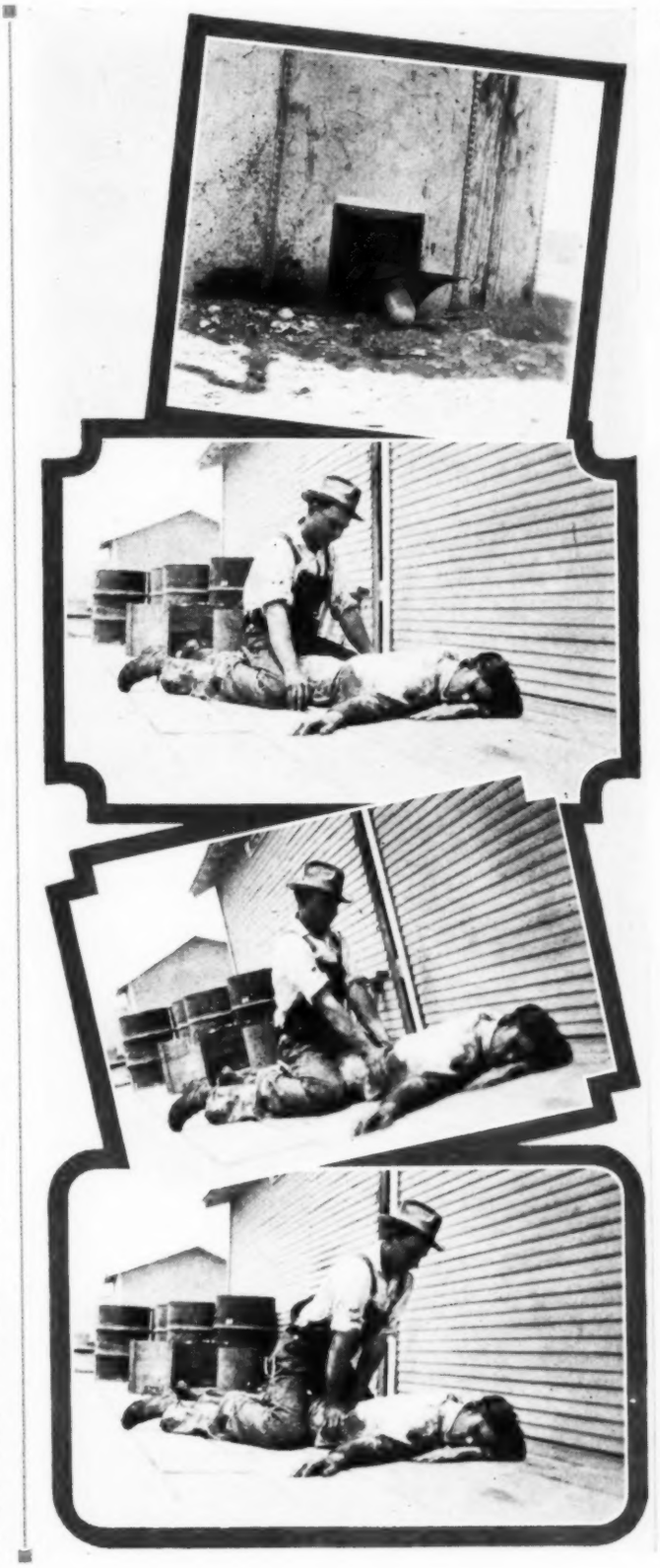
A steam suction jet is oftentimes placed in the top hatch after a tank has been washed and steamed to draw off steam or vapors. The suction jet discharges in the air.

After the tank has been steamed until it is considered to be gas free, manhole covers and preferably a side sheet should be removed to allow the vessel to cool and to permit free circulation of air.

After the tank has been steamed and aired, an analysis of the contents should be made. If the atmosphere contains 0.2 per cent or more of combustible gases it is considered unsafe to breathe and unsafe for "hot work."

Some companies require that canister type gas masks be worn on tank cleaning operations regardless of the fact that the percentage of combustible gases present show to be under the lower explosive limits. This precaution is advisable in view of the fact that vapors will be released when the sediment is stirred up and also because gas pockets or accumulations may exist at points in the tank at which no sample was taken or test made. Care must be taken to blank off steam and foamite lines to prevent live steam or fluid to enter the tank while men are inside.

The above method of steaming tanks is advisable and should be followed where a supply of steam and water is available, but most often field storage tanks are far removed from an adequate steam and water supply. It would, in most cases, require the installation of a boiler and water supply line to steam and wash them. This, of course, is costly and most often prohibitive, particularly so when the tanks are not cleaned often and perhaps only one at a time.



Top to bottom—Two men were asphyxiated in this tank. The first man entered the tank to "flange up" a connection and the second man entered in an attempt to rescue the first when he was overcome. Neither men wore masks and the tank was not left open to air out. The manhole plate was taken off to permit the removal of their bodies. Administering artificial respiration: The operator assumes a position straddling the victim's body with hands resting upon the lower ribs. The operator relaxes, allowing the patient's lungs to fill by atmospheric pressure. Air is forced from the lungs by pressure applied on the lower ribs.

Where steam and water is not available the best practice is to remove two side sheets, one on either side of the tank, and permit the tank to air out two or three days or longer if possible. When it is necessary to carry on the cleaning operations without first steaming the tank, workmen should be required to wear hose type mask equipped with blower and no hot work (welding or riveting) should be undertaken unless a test shows the tank safe for such operation.

The above procedure is usually followed in cleaning stock or flow tanks on leases where it is necessary for workmen to enter the tank, however, many companies are installing "bull plugs" in the side manhole sheet of the smaller tanks, 1,000-barrel or less, which will permit the removal of the manhole plate and cleaning of the tank from the outside. This is considered an excellent practice and certainly eliminates a serious hazard.

Metal scrapers, other than brass, should not be used in removing sediment accumulation from a tank and any hand tools used should be of the "non-sparking" type. Only gas-tight flash and portable lights should be used. Combustible gases in sufficient quantities to ignite might accumulate in the cleaning process and be "set off" by a spark thus created.

The methods employed in cleaning sour crude tanks do not vary greatly from those used in other cleaning operations. There are, however, a few additional precautions necessary.

Before the work of disconnecting lines and blanking off is started on a

"sour" crude tank, tests should be made to determine whether or not hydrogen sulphide exists in dangerous concentrations around or on the tank where disconnecting work is to be done.

The individual making these tests should wear a canister mask and a second man should remain outside the fire wall with hose mask available so as to be able to go to the rescue of the first man should he be overcome.

It is absolutely essential to scrape and wash down the walls and roof of a sour crude tank and to hose down sediment accumulation as the scale (iron sulphide) is likely to heat to a glow when combined with oxygen and ignite vapors that may be present.

Some companies consider it unsafe to permit workmen to enter a tank that has contained hydrogen sulphide crude without a hose type mask equipped with blower regardless of how long the tank has been steamed, and whether or not tests show H^2S concentration to be low. The hose type mask offers greater protection and this added precaution is justified.

Tank cars should be steamed in the same way as other vessels before they are entered and only hose type mask with blower attachment should be worn by workmen entering the cars. It is difficult to ventilate the tank car so as to supply a sufficient amount of air and the canister mask is, therefore, not suitable for the work.

An interesting report of a tank car explosion comes from a Canadian Company. The car was being steamed out when the explosion occurred. Investigation developed that the car was not grounded and apparently the combustible vapors in the car were ignited by static electricity generated by the flow of steam through the line. This case indicates the necessity of properly grounding tank cars, tracks and loading facilities. A bonded hose should also be used in the steaming process.

The percentage concentration of any individual gas or vapor in air can be determined by instruments while others indicate only the degree of explosibility of the atmosphere. Most of these instruments are simple in operation and can be used by the average worker after thorough instructions are given.

Taking the reading with detector head inside tank.

Testing a tank with Combustible Gas Indicator. The operator is preparing to lower the detector head into the tank.

One indicator in particular is simple in use, the scale being divided into fifty equal parts with a section in red. When the indicator needle enters the red field it shows exactly 0.02 indicated as pentanes. That, according to Fire Underwriters' recommendations, is not safe for fire, even though it is way below the lower explosive limits and allows a great factor of safety. The entrance of the needle in the red field indicates also that gas and vapor exist in such quantity as to endanger life. This indicator can be easily carried about the plant or field and tests can be made at the tanks in a comparatively short time.

The Tutwillier instrument is perhaps the most commonly used for the purpose of determining hydrogen sulphide concentration. Lead acetate paper is also used, but is not considered dependable by some companies who report that coloring of the paper is noticeable within a comparatively short time in atmosphere containing very low concentration of H^2S.

In cleaning both "sweet" and "sour" crude tanks tests should be made frequently to determine gas conditions. The frequency of the tests should be determined by the supervisor in charge, but once each hour is considered the maximum time between tests.

Concentrations of as low as 0.010 per cent H^2S will cause irritation to the eyes and throat and it is particularly important that accumulation of high concentrations be avoided.

There are three types of apparatus to protect men working in places where poisonous gases or vapors are found; namely, the canister type gas mask, the fresh-air hose mask, and the self-contained oxygen breathing apparatus. The fresh-air hose mask and the canister type gas mask are the two most commonly used in the petroleum industry.

As previously explained, the canister type gas mask is suitable for use only where a supply of oxygen is available. It is a filter and not an oxygen generator. It is particularly adapted to gauging, work on the derrick floor, or on other jobs in the open.

Canisters lose their filtering quality after a relatively short period of time and a time record should be kept of each hour that it is used. Instructions as to its use are given with the canister and should be closely followed.

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failures are due, primarily, to "fatigue". Only a rod with an ample margin of tensile strength can correct this.

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Inasmuch as fatigue resistance is in proportion to ultimate strength, Jones Rods are, therefore, more enduring and necessarily less liable to cause trouble.

Every known laboratory test confirms this advantage of Jones Rods—actual field performance verifies all laboratory tests. Moreover, all Jones Rods *truly* conform to A.P.I. specifications in *all* details.

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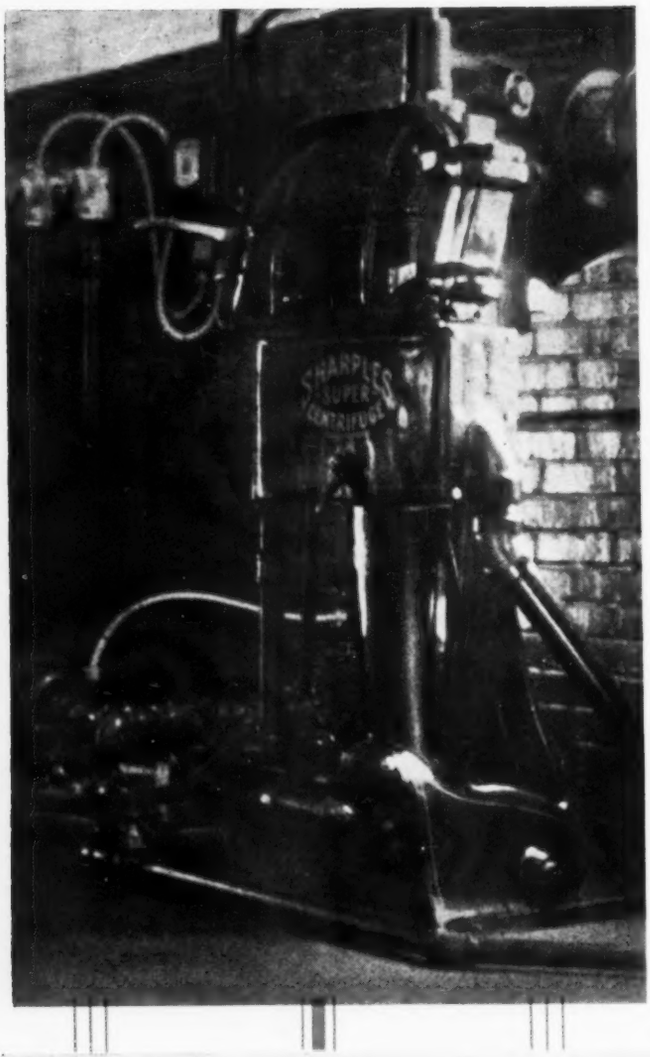
Reclaiming Used Aviation Oil

By MERRILL GRIX, *Chief Engineer, Southwest Air Fast Express*



THE engineering department of the Safeway lines has installed a unit for reclaiming used aviation oil so that the product is satisfactory for further use in its trimotored ships. The company's offices and shops are located at the Tulsa Municipal Airport. This port handles more passengers than any other in the world, and about 60 per cent of these are carried in Safeway planes. The company operates eleven trimotored and four single-motored ships powered with Pratt & Whitney Wasp engines.

Due to the large amount of aviation oil used in the operation of the ships, considerable drained oil was accumulated at the hangar. The engineering department of the company, in coöperation with consulting chemists, studied the problem of recovering this oil at a minimum cost, and, after carrying on a research program to study the various processes suitable for reclaiming the oil, the present installation was made.

Process

The unit has a capacity of 200 gallons of oil per day and recovers about 95 per cent of the feed. The first step in the process is to strain the used oil through a fine copper screen to remove any suspended matter. It is then pumped into a mixing tank and circulated by means of a rotary pump through two electrical heaters, which brings the temperature of the oil up to 220 degrees F. The pump is driven with a half-horsepower motor and 1¼-inch lines are used.

After the temperature reaches 220 degrees F., sodium silicate (water glass) is added, using one gallon for each 50 gallons of oil. The mixture is agitated with air jets for 10 minutes in the mixing tank. Then 10 gallons of hot water are added to the mixture. This mixture is then fed to the super-centrifuge machine at the rate of 50 gallons per hour. The water and sludge come out of one discharge and the treated oil from the other. The oil is then pumped into a receiving tank, the temperature being about 180 degrees F. It is blown with air in this tank to remove any traces of moisture. From here it is run in 50-gallon drums for storage.

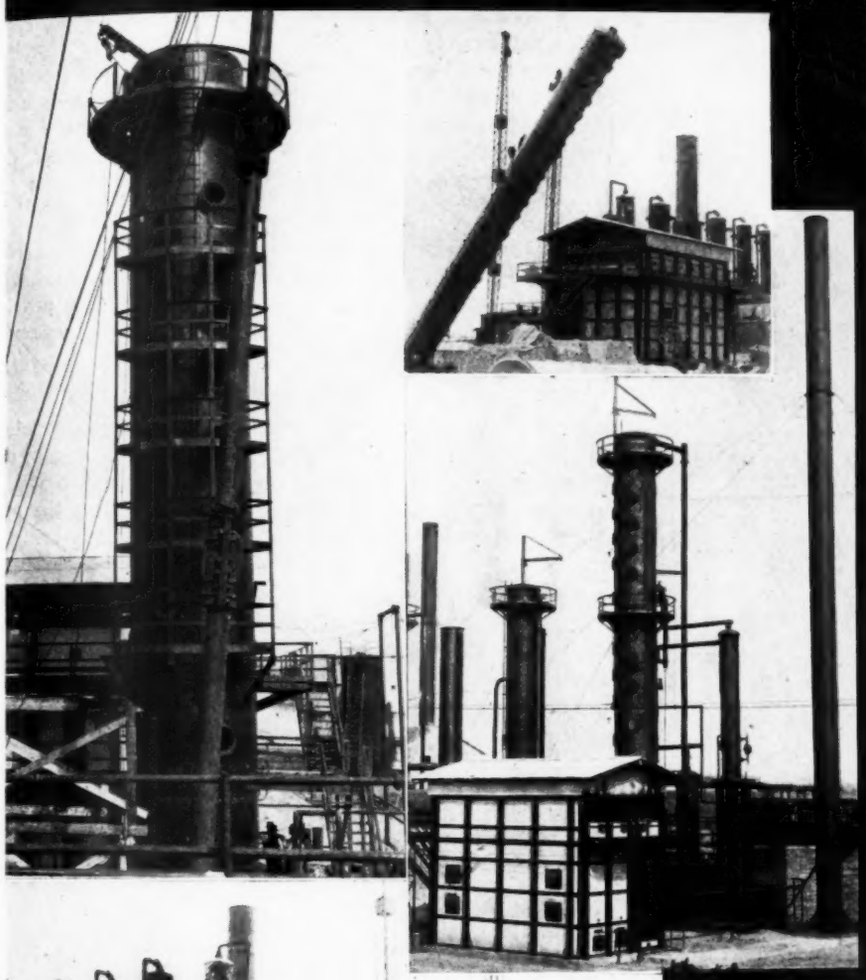
Top—Merrill Grix, chief engineer, Safeway Lines. Center—Centrifuge in reclaiming plant. Bottom—Office of Safeway Lines, Municipal Airport, Tulsa, Okla.

Since aviation oil used in the air-cooled radial engine contains less than 1 per cent dilution after 25 hours of service and the low end point aviation gasoline contains no heavy ends, the dilution is readily removed in the mixing tank with air at the temperatures described without subjecting the oil to a distillation process.

A sample of the reclaimed oil showed the following tests:

Saybolt viscosity	125 at 210° F.
Gravity	23.9° A. P. I.
Flash open cup	500° F.
Carbon residue	2.0%
Water and sediment	0.2%

-From The Ground Up!



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6 EASE OF CONTROL
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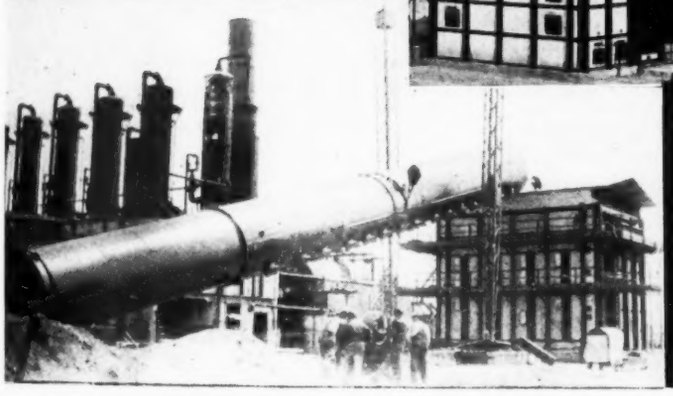

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Ohio River Crossing Was

By **WARREN L. BAKER**

ONE of the most interesting construction features encountered in laying overland pipe lines for oil, natural gas, or city gas is the pipe line river crossing. Recently there have been several noteworthy river crossings completed, which have added many chapters to the development in this field. River crossings with pipe lines are no longer a serious problem to the construction engineer, due largely to the strict procedure control methods that are followed.

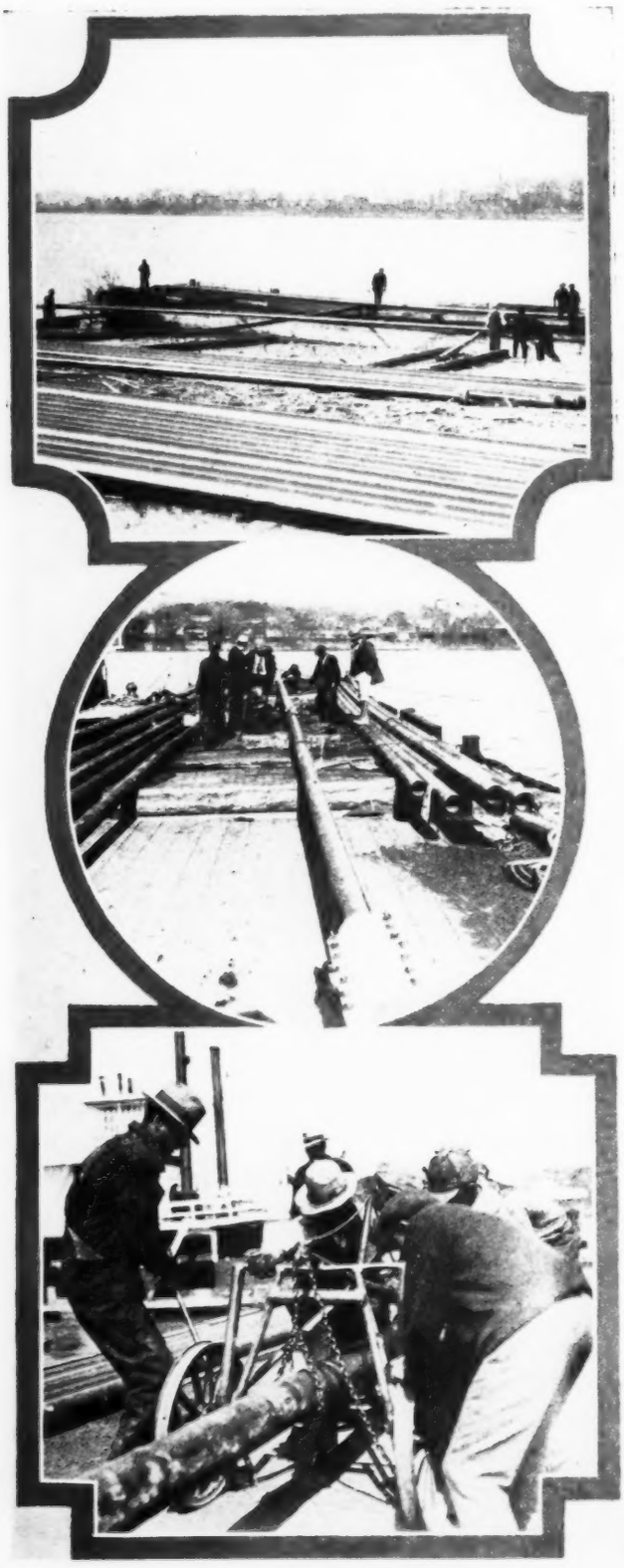
A six-inch natural gas pipe line was completed across the Ohio River in a very short time. The crossing consists of three identical lines. The three lines were laid to provide for future expansion. The first line was arched upstream 300 feet, the second 275 feet and the third 250 feet. The methods of laying of the three lines were exactly the same.

At the site of the river crossing the width of the river was 2,165 feet, and the maximum depth about 30 feet. Four buoys were anchored in the river for marking the course to be taken by the pipe. The barge used for laying the pipe followed these buoys during the laying operation; thus the desired upstream arch was placed on the pipe.

Pipe used for the crossing was delivered in double (40-foot) random lengths in freight cars, and unloaded on the river bank near the scene of the crossing. These were welded together on the shore to form double lengths of approximately 80 feet each. The completed double lengths were painted with a protective coating and pieces of burlap were tied over the ends of the pipe to prevent the entrance of leaves or debris. A caterpillar tractor equipped with a derrick made from welded pipe was used for moving the pipe during these operations.

The downhill slope of the bank was taken advantage of in loading the pipe on the barge. These double-length joints were rolled by hand onto the barge over skids, which were made of double lengths of pipe.

Two barges were used in laying the crossing. A 30-foot barge was lashed back of the 75-foot one. Supplies necessary for the construction of the crossing including an acetylene generator, cylinders of oxygen, drums of carbide, welding apparatus and welding rod, drums of protective



Top to bottom—Loading double length pipe on barge. General view of loading pipe on barge, looking forward. Using the special hand truck. Lower right—General view of barge, showing tractor used.

Completed *in* Four Days

enamel, river clamps and bolts, tractor, crowbars and other supplies were loaded on one of the barges prior to the start of operations.

The two barges were then towed to the starting point of the crossing by means of a river steamboat, which was employed for the purpose of maintaining the position of the barges, shifting anchors and various other operations.

In laying the pipe, double lengths of it to be added to the line were brought into position with the aid of crowbars and a special hand-truck, constructed of welded small-diameter pipe. When in position the ends of the pipe were aligned by means of a clamp and tack welded by two welders working simultaneously on opposite sides of the pipe. The clamp was then removed and a butt weld made, two welders also working simultaneously on this weld.

Three reinforcing straps were added at each joint after the completion of the weld. A coat of protective enamel was applied to each joint upon completion. The river clamps weighed 300 pounds apiece. Recesses were provided in the castings for the reinforcing straps. The purpose of the clamps was to sink the line and anchor it firmly in place on the river bottom so that it would not shift because of the river current.

As each double length of pipe was added to the line it was necessary to move the barge forward approximately 80 feet. For this purpose the caterpillar derrick tractor, mentioned previously, was carried on the smaller barge. When a joint was completed the tractor was made fast to the pipe by means of a chain and moved toward the stern of the smaller barge, a distance of about 20 feet. Then the tractor was backed up, took another hold and the operation repeated. After repeating four times, the barge had moved forward the sufficient length. Helpers at various intervals aided in keeping the barge in alignment by means of crowbars during this process. Each time the barge was moved forward it was necessary to move the anchor, which was done by means of the steamboat.

Despite the fact that work was carried on only during daylight hours and that work was suspended one day due to weather, the crossing was completed in four days from the time it was started.

Top to bottom—Attaching river clamps. Moving the barge. The finish of the crossing. Lower left—Applying protective coating prior to attaching river clamp.

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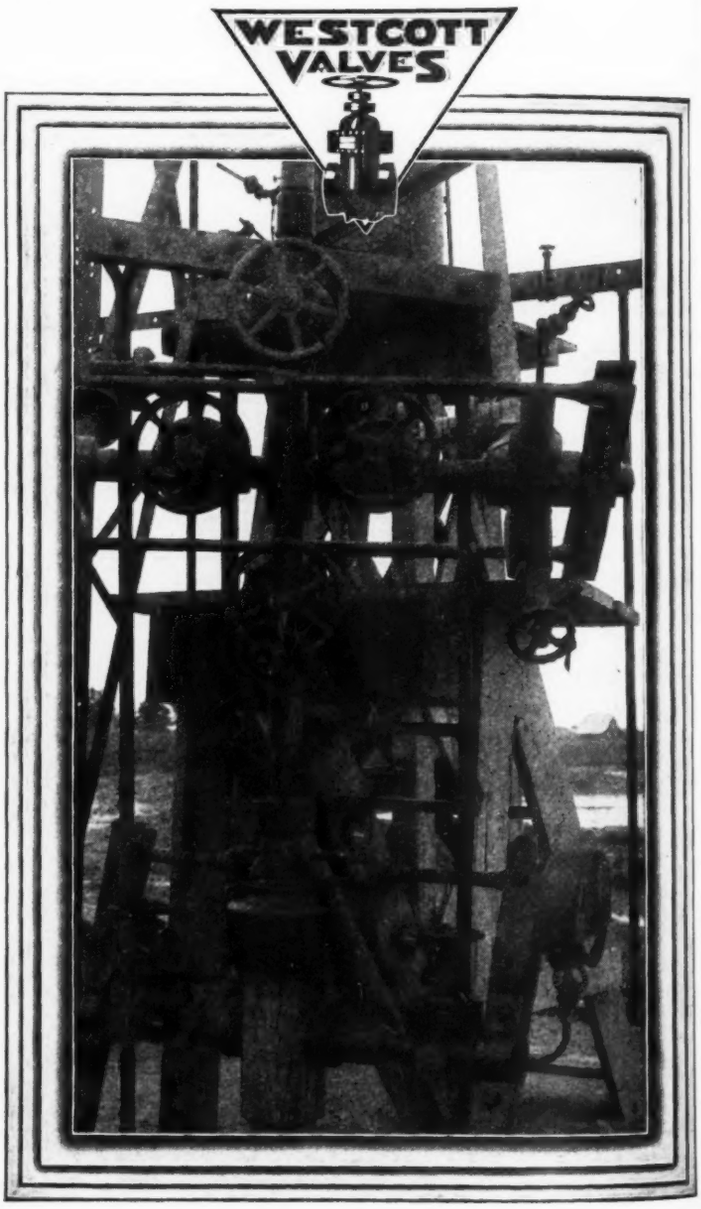

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The Trend *of* Research *in* NAPHTHOLOGY

By
DR. A. E. DUNSTAN
Anglo-Persian Oil Co., Ltd.

THIS industry in recent times has shared the common industrial handicap of over-production and lower prices, but in spite of this it is encouraging to record the extensive modernization of plant and equipment and the general desire toward the so-called "rationalization." This article will in a very brief way, it is hoped, generalize on the result of recent developments and conclude with some notes in general on the future.

Hydrogenation

Considerable interest on both sides of the Atlantic has been aroused by the agreement reached between the I. G. group in Germany and the Standard Oil of New Jersey to pool their great resources in the utilization of hydrogenation in the production of light liquid fuels.

It is well-known that the former company has met with some success in the treatment of lignite tars and this is further evidenced by the purchases of low temperature tars from different sources by this company. So far as the liquefaction of coal is concerned, optimistic statements have been made, but the controlling factor is obviously the price of gasoline, which shows no serious signs of rising. Indeed the increasing success of modernized production methods, and the intensive study of refining and cracking, have led to the inevitable conclusion that for many years to come there will be no shortage of mineral oil.

Whilst, therefore, the hydrogenation of coal and its derivatives affords no prospect of ousting petroleum, yet there is definite evidence that success may attend the corresponding treatment of heavy refinery residues. Today, and probably for a long time, the fluid light oils—petrol, kerosene, and gas oil—will be in demand; with the heavy viscous residue little can be done except as bunker fuel. Even with modern cracking equipment, some considerable proportion of an average crude oil is left as heavy residue (unless, indeed, it is reduced to unprofitable coke), and it is to the conversion of this low-valued material that hydrogenation offers attractive prospects, particularly in those localities where very cheap natural gas is available as a source of inexpensive hydrogen. Although in the sequel a variety of catalysts and catalytic processes will be indicated, there is no general agreement as to the nature of the catalysts that promote reduction, and, in point of fact, almost every conceivable combination of the elements has been put forward and patented.

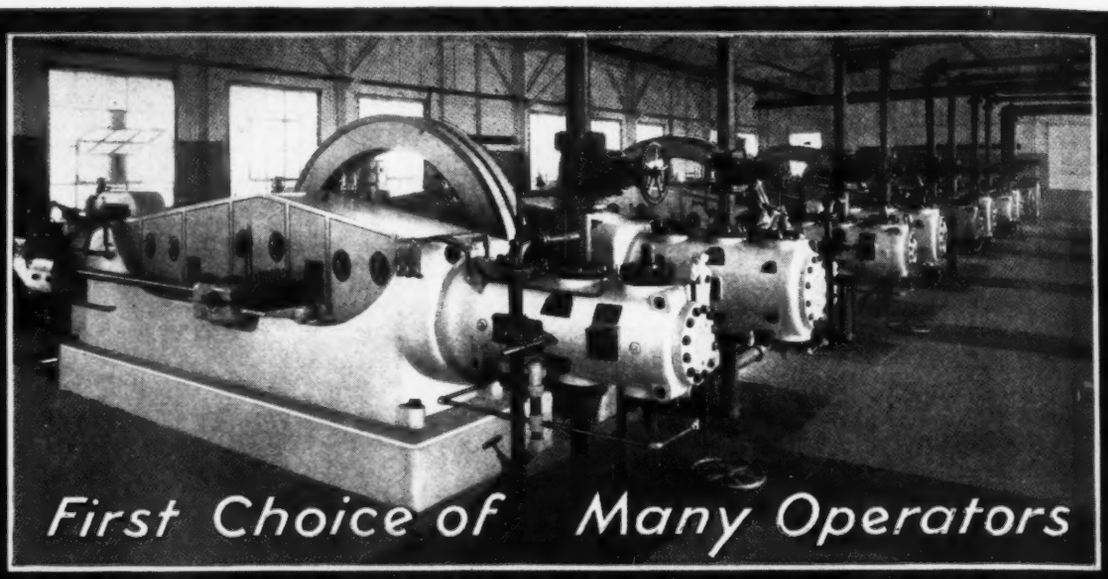
Catalysis in Relation to Cracking and Hydrogenation

There is no sign of abatement of the spate of patents in this direction, but still the actually operated cracking processes remain very few in number, and the general cracking situation is not much changed except that there is a steady trend to higher temperature. This movement is clearly explicable when it is realized that high anti-knock spirit results when cracking is carried on at about 600 degrees. In many of the newer patents the aid of catalysis is invoked, and it is becoming more and more difficult to find any material that may conceivably possess catalytic power that has not been protected.

The I. G. Farbenindustrie for example last year obtained a patent for the production of high and continuous yields of hydrocarbons from mixtures of oxides of carbon and hydrogenous gases with the use of a catalyst (oxides of iron, cobalt, nickel, etc.), containing 0.4-0.6 per cent of alkalies calculated as metals. A further process covered was the treatment of hydrocarbons of any origin including tars by subjecting them to the action of gaseous halogen hydride at temperatures over 100 degrees in the presence of a large variety of pure or alloy metal catalysts.

It is gratifying to note, however, that more attention is being given to the general theoretical considerations that underlie the cracking process. In this connection a theory was evolved toward the end of the year for oils consisting

How a modern carbon black plant looks from the air.



Five Type-80 four-cycle twins direct-driving gas compressors in the Sinclair Oil and Gas Company's station in the Oklahoma City field. Another Sinclair station houses 36 of these units.

COOPER-BESSEMER TYPE-80

"If they left it to me, I'd put the BLUE RIBBON on Type-80's every time!" That's the way many engine operators feel about these 170 B. H. P. compressor units. Type-80's are engineered with "big engine" thoroughness—reducing shut-down losses to a minimum.

Any Type-80 operator can point out to you many features which make these 4-cycle engines simple to inspect, adjust and repair, with little or no sacrifice of running time. All reciprocating parts are completely accessible. Indicator cards can be easily taken on both power and compressor cylinders — adjustments made (if needed) — and the engine put back on the load in record time.

If you would like to know about the many improved features of the new Type-80, ask us to send the illustrated Bulletin.

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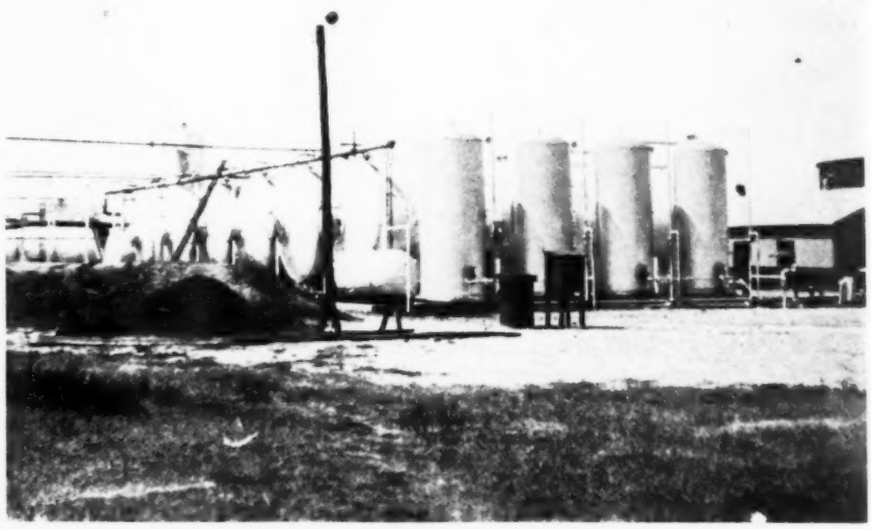
only of paraffins and unsaturated hydrocarbons. It is assumed that the oil had been in the reaction chamber long enough for equilibrium to have been established between all the substances present, and that no coke is deposited in the reaction chamber, and applying the results obtained in previous investigations of the chemical equilibrium in mixtures of paraffins and unsaturated hydrocarbons, the fractions of the oil coming out of the reaction chamber as liquid, vapor, gas, gasoline, and unsaturated hydrocarbons are calculated. The values of these fractions (in weight percentages) for four hypothetical oils having the assumed compositions $CH_{2.1}$, $CH_{2.15}$, $CH_{2.2}$, and $CH_{2.25}$, (corresponding, roughly, to fuel oil, crude oil, gas oil, and kerosene), at temperatures ranging from 400 degrees to 760 degrees, and pressures from 7.5 to 60 atm., are tabulated. It is found that there is good general agreement between the calculated results for the hypothetical oils and the results obtained with actual oils, and it is concluded that the hypothetical oils resemble actual oils sufficiently closely for the theory of the cracking of the former to represent the main features of actual cracking, thus confirming Bertholot's suggestion that approximate equilibrium must be attained in actual cracking operations.

Some light was thrown on the so-called "liquid phase", cracking processes by the determination of the temperatures above which an oil can longer exist as a liquid and the real critical temperatures of a number of petroleum fractions such as gas oils, gasolines, etc. It was noticed that with asphaltic base products no precipitation occurred when they were heated above the critical temperature. This work indicates very clearly that many of the so-called "liquid-phase" cracking processes are in reality "critical phase" processes.



Gasoline treating plant in a modern refinery.

Refining

In this branch of the industry the year has seen a slight decline in the multitude of sulphuric acid processes, and a general increase in alkaline and other methods of treatment.

Composite methods of treatment are now more in evidence, and appear to be necessary to attain the high standards necessary for market competition; for example a suitable hydrocarbon stock is treated successfully with a sodium plumbite solution and with sulphuric acid before being cracked. Another process covered in the year illustrating this point is the treatment of gasoline stock (preferably after treatment with sodium hydroxide or hypochlorite) which is cooled and treated with amount 25 per cent of liquid sulphur dioxide at 8 degrees, then passed in countercurrent with fuming sulphuric acid (3.15% SO_2), and the remainder of the sulphur dioxide removed by heat, and cooled and compressed for re-use.

The growing utilization of sulphur dioxide in refining for reduction of sulphur content and improvement in color and odor is also noticeable. As the sulphur content of crudes now being produced appears to be on the increase, desulphurization should be of growing interest.

In the treatment of hydrocarbons with liquid sulphur dioxide in one process the latter is recovered from its mixtures with hydrocarbons by evaporation in intermediate and final stages being obtained by a jet apparatus operated by the sulphur dioxide vapor from the first-stage evaporators, which are heated to give the required increase of pressure. The reduction in pressure obtained by means of the jet is also employed to remove sulphur dioxide vapor from the cooler, the liquid sulphur dioxide in which is thus brought down to the temperature required for treatment of the oil.

The treatment of sulphurous hydrocarbons with hydrogen at high temperatures to remove the sulphur in the form of hydrogen sulphide has been taken up in Germany too by a process in which benzene and naphthalene are freed from sulphur by treating them with hydrogen at elevated temperatures (200-300 degrees) and, if desired, under elevated pressures, in the presence of a metallic sulphide, e. g., molybdenum or nickel sulphide, which is stable under the conditions of working. The metallic sulphide may be mixed with a metallic activator, e. g., chromium or cobalt oxide, and is preferably deposited on a carrier, e. g., activated charcoal. The organic sulphur compounds are converted into hydrogen sulphide. If this is then removed, the mixture of benzene, or other hydrocarbon, with the excess hydrogen, may be passed directly over a hydrogenating catalyst for the production of cyclohexane, etc.

The color of marketed products has always been of importance. In a recent patent discoloration due to autoxidation is prevented from forming in, kerosene and gasoline, by the addition of an aromatic or aliphatic dihydroxy-compound, aromatic amine, phenol, urea or urea derivative, in the proportion of not more than 1 pt. per 10,000 pts. of petroleum distillate. Suggested compounds are quinol, pyrogallol, resorcinol, pyrocatechol, thiourea, etc.

Gasoline

Practically all the attention given to motor spirit during the year under review has been concentrated on the various problems of detonation and anti-knocking rating. Opinion has hardened in favor of a direct engine test rather than any method of chemical or physical analysis, and informal conversations between groups of experts, both in England and in America, appear to be tending towards a standardization of method in this direction. Perhaps more important than the type of engine is the method of expressing the rating of the spirit, and it seems probable that Graham Edgar's proposal to employ pure pro-knock and anti-knock hydrocarbons as reference fuels will be selected.

A further contribution to the subject was to the effect that divergencies between results from different laboratories are probably due to failure properly to control variables on account of lack of appreciation of the effect of these variables. In order of importance they are mixture strength, ignition setting (where this is varied), speed, air-intake temperature, and water-jacket temperature. Values expressed in terms of compression ratio or differences between compression ratios apply only to the engines and conditions on which the tests are made. Matching of a sample against standard blends by audibility or bouncing-pin methods must be at an air-fuel ratio giving maximum pinking with the sample. Large errors may arise if the anti-knock values of two spirits from different sources are compared by determining the amount of an anti-knock required to bring each to a much higher standard. The bouncing pin, operated from a diaphragm, appears to be the most accurate for evaluating samples in terms of standard hydrocarbon blends. It can be used without fatigue, it is independent of engine noise, and it needs very little attention to secure consistent results.

The study of the actual theory of detonation has also been continued during the year. It has been found that an increase in temperature of pentane-air mixtures slightly widened the range in which pinking occurred, and with benzene-air mixtures a narrow range giving faintly audible explosions was found. Previous observations, that the addition of benzene, the combustion of which is continuous throughout the explosion, to pentane, reduced the likelihood of a pinking explosion by reducing the amount of chemical energy available to maintain a shock-wave when the initial wave is arrested, were confirmed. Addition of "pro-knocks," e. g., ethyl ether and amyl nitrite, reduces the amount of afterglow in the wake of the flame, and gives a correspondingly more intense glow at the moment of pinking. When carbon dioxide and steam were added to pentane-air mixtures, it was found that with the former, the range of mixtures giving pinking explosions was narrowed, and, with the latter, the spread of the flame and its luminosity were progressively decreased with increase in amount of water vapor added, the audibility of the pinking was greatly reduced, and the afterglow nearly eliminated. With carbon disulphide-air mixtures combustion was continuous and long-continued behind the flame front. No mixture of hydrogen and air was found which gave a pinking explosion similar to that with pentane-air mixtures.

Gas

Interest continues to be taken in the attempt to convert the lower paraffin hydrocarbons into olefinic and aromatic material. Thus for the production of aromatic hydrocarbons, a stream of gas containing gaseous paraffins is gradually heated to a temperature substantially below that at which eventual decomposition is to be carried out (3.g., below 550 degrees). It is then heated in a determined course to a temperature (650-975 degrees), at which the paraffins are decomposed and aromatic hydrocarbons are formed. The stream of gas is then suddenly reduced in velocity, and cooled, and the free carbon formed is deposited; finally the aromatic hydrocarbons are condensed. The yield of aromatic hydrocarbons is increased by diluting the gas with an inert gaseous material (steam), which is preferably introduced into the gas stream between the pre-heater and the reaction tubes. The reaction temperature is controlled according to which paraffin is present. The temperatures are 850-975 degrees, 800-900 degrees, 750-850 degrees, 700-800 degrees, or 650-750 degrees for methane, ethane, propane, butane, or pentane, respectively; for mixtures, a range of temperature is chosen according to the average proportions of the constituents. The velocity of the gas in the pre-heater tubes and in the reaction tubes is so maintained that the flow is turbulent, giving good heat-transference.

It has been shown that when methane is heated in a quartz vessel it begins to decompose at 650-685 degrees. At higher temperatures (975-1100 degrees) benzene, naphthalene, ethylene, and butadiene were among the products of decomposition. The optimum yield of benzene (0.2 gal. per 1000 cu. ft. of methane) was obtained by passing the gas at about 30 litres per hr. through a horizontal quartz tube maintained at 1050 degrees. Above 1000 degrees some carbon smoke is formed. Increasing the area of heated surface, whether this be of quartz, porcelain or copper, had little influence on the course of the reaction, but in the presence of iron the gas is decomposed into its elements, no condensable products being obtained. Dilution of the methane with nitrogen had little effect on the yield of liquid hydrocarbons, but dilutation with hydrogen produced a marked decrease in the yields.

Again by passing a stream of methane through silica tubes heated to 1000-1200 degrees, liquid, solid, and high gaseous hydrocarbons were produced. The liquid and solid products were chiefly of aromatic nature. Among these were identified, besides hydrogen, acetylene, ethylene, and small quantities of ethane, higher olefines, and aromatic hydrocarbons. For each temperature there is a heating period which gives optimum yields of higher products, the duration of which is increased by rise in temperature. The best yields of higher hydrocarbons were obtained at a temperature of 1150 degrees and a heating duration of 0.6 sec. Under these conditions the yield of a light oil and tar was 11.0 per cent calculated on the methane used, while the quantities of acetylene and ethylene in the reaction gas corresponded to a total conversion of methane into these gases of 8.8 per cent. Thus the total conversion of methane into higher hydrocarbons was nearly 20 per cent of the theoretical. The yield of light oil was 4.8 per cent, or 0.2 gal. per 1000 cu. ft. of methane. The use of comparatively long heating periods tended to cause methane to decompose into its elements almost exclusively, this tendency being greatly increased by the use of large heating surfaces and of catalytically active materials such as iron and nickel.

The possibility of using butane, pentane and ethane to enrich water gas instead of cracking gas oil will steadily become more important with the demand growing for light Diesel oils.

Wide interest has been aroused and a variety of processes have been covered for connecting lower paraffins to olefines.

Lubricating Oils

The present tendency in the manufacture of lubricating oils is to use the highest possible vacuum in the primary distillation so as to avoid thermal decomposition, but increasing attention is being given to treatment with liquid sulphur dioxide with the object of removing those substances, highly unsaturated and resinous, that cause undue reversion and lack of permanency in service. Coupled with this is the increasing effort to lower the pour point by more and more complete removal of solid paraffins.

So low temperatures as —40 degrees and 50 degrees F. are becoming customary in refrigeration before centrifugal or filtration treatment. At the same time, it is being realized that intensive acid washing is thoroughly unsatisfactory in that those compounds that promote "Oilness" are thereby removed. Final soda treatment is now largely replaced by agitation with absorbent clay.

On the academic side of this subject excellent work has been done. It has been shown that it is impossible to determine the molecular weight of lubricating oils from their surface tensions, because KE in the Eotvos-Ramsey-Shields

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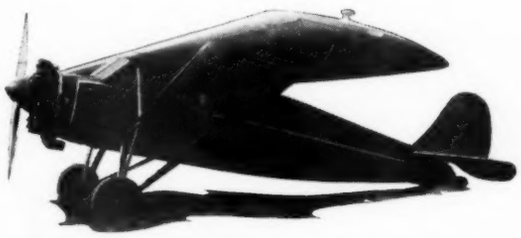

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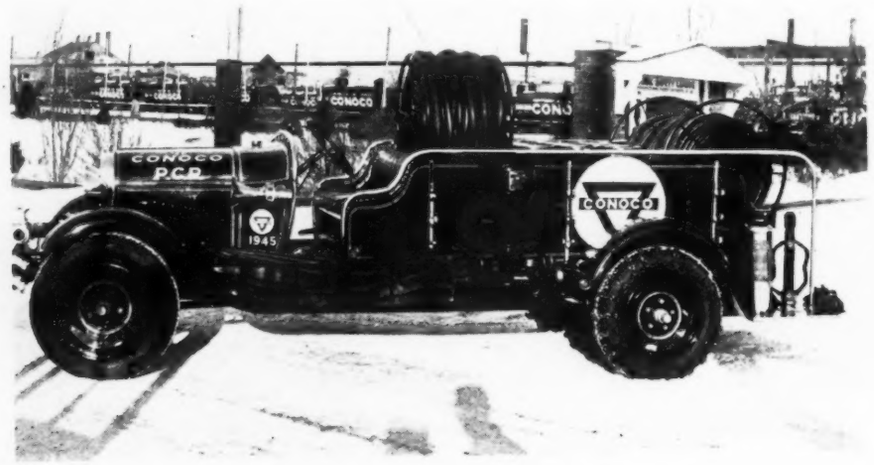
equation is not constant. Given the molecular weight, it is, however, possible to evaluate KE and thus obtain an approximate value for the critical temperature and b.p. of oils, the b.p. of which can only be determined in the ordinary way with difficulty or not at all. Surface tension and viscosity vary in the same sense with temperature. Determinations of viscosity are best conducted by measuring the rate of outflow of oil from between highly polished, optically plane, metallic surfaces under a known load; the system of oil-metal-oil forms an electrical condenser of which the alteration in capacity gives a measure of the outflow of oil during a given time interval. The time required for a given quantity of oil to be expressed increases with the viscosity and is inversely proportional to the load. The Poiseuille equation is still valid for the oils investigated when the oil film is only 0.003 mm. thick.

It has been further demonstrated that the relation between refractive index and molecular weight is represented by separate curves for normal paraffins, insoparaffins, naphthenes, and aromatic hydrocarbons, and the determination of these two constants for a mixture of hydrocarbons of unknown character enables it to be classified. The method has been applied to a number of mineral lubricating oils in cases where the great complexity of the mixtures makes identification by chemical means impracticable. The lower lubricating value of oils containing normal paraffins is due partly to the superior lubricating properties of branched-chain as compared with straight-chain molecules, but largely also to the fact that in a mixture of given b.p. the normal paraffins have a lower mol. wt. than the isoparaffins, and consequently lower lubricating power.

These investigations, however, have ignored the importance of the colloidal interpretation of the fundamental properties of lubricating oils.

Refinery Fire Fighting Equipment

THE establishing of an efficient fire-fighting machinery, which includes, besides the proper equipment, the training of employes regarding their behavior for such an emergency, requires the careful study and attention of every refinery or gasoline plant superintendent.



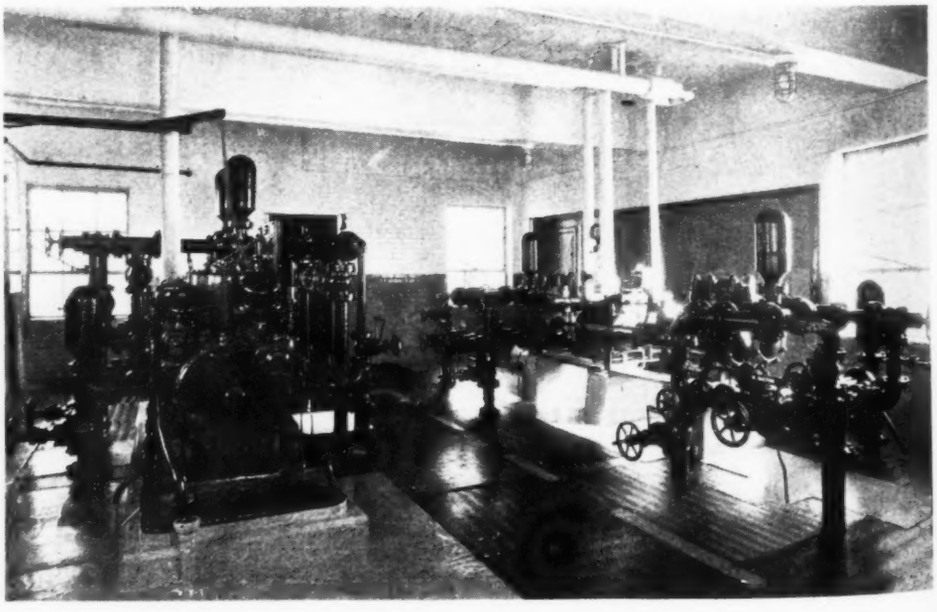
Fire Truck of the Continental Oil Company at Ponca City.

Many of the larger plants have elaborate systems for fire fighting and prevention, involving large investments for equipment. Some of the plants have their own fire trucks, which are equipped with foam generators and other valuable machinery.

In the past few years considerable advancement has been made by engineers employed by the various equipment manufacturers in making more efficient apparatus for fighting oil fires, especially in refineries and gasoline plants.

Among other improvements has been that of the development of the continuous foam generator. This machine produces a large sized and sustained stream of foam by introducing a dry chemical powder into a flowing stream of water. The powder is poured into a hopper connected to the water line at the time of the fire. It is light in weight and can be carried to within 150 feet of the fire, where it is connected by means of a hose line to a hydrant or other source of water supply. A second line, provided with a nozzle permits the foam to reach the flames.

An older practice and one still in use in many refineries is where two tanks are erected in which two different chemical solutions are stored. At the time of a fire these solutions are mixed in one line and carried to the blaze. These require pump houses, while it is a custom for the solution tanks to be covered with hollow tile walls to protect the tanks and contents from the weather conditions.



Interior of Foamite Pump House No. 2, at Continental Oil Company's Ponca City Refinery.

HOT OIL TURBINE PUMPS FOR RECYCLING

THE Louisiana Oil Refining Company at Shreveport has recently installed three turbine-driven centrifugal type hot oil pumps for recycle stock on the cracking units to replace an old pump installation. The new selection was made after careful study by engineers of the company. R. B. Pierce, manager of refineries, states the new installations are giving very satisfactory service. A uniform rate of discharge is maintained which materially improves the operation of the cracking process. Due to the ease of control, the operating men are very well pleased with the new pumps.

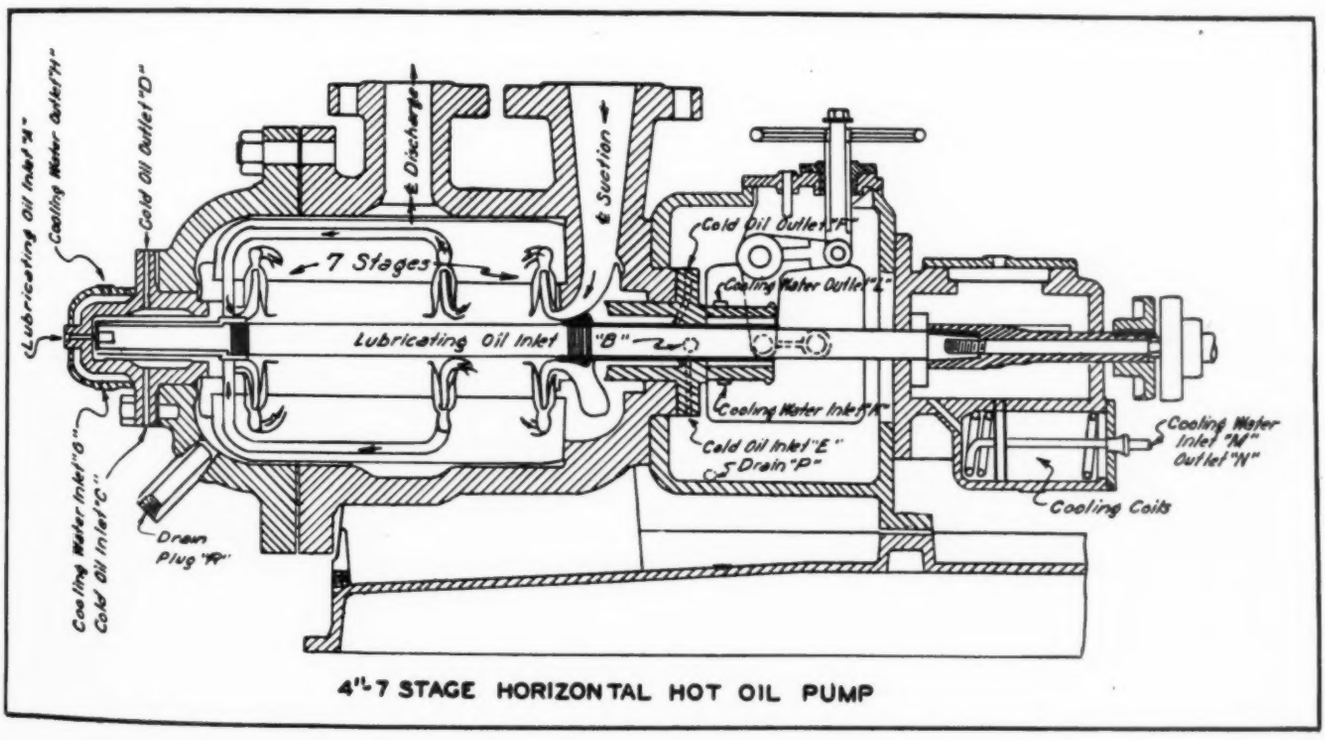
Description

The new pumps are seven-stage, horizontal type centrifugal pumps, direct connected, steam turbine driven, operated with 100 pound initial steam pressure and 27 inches of mercury vacuum maintained by a barometric condenser.

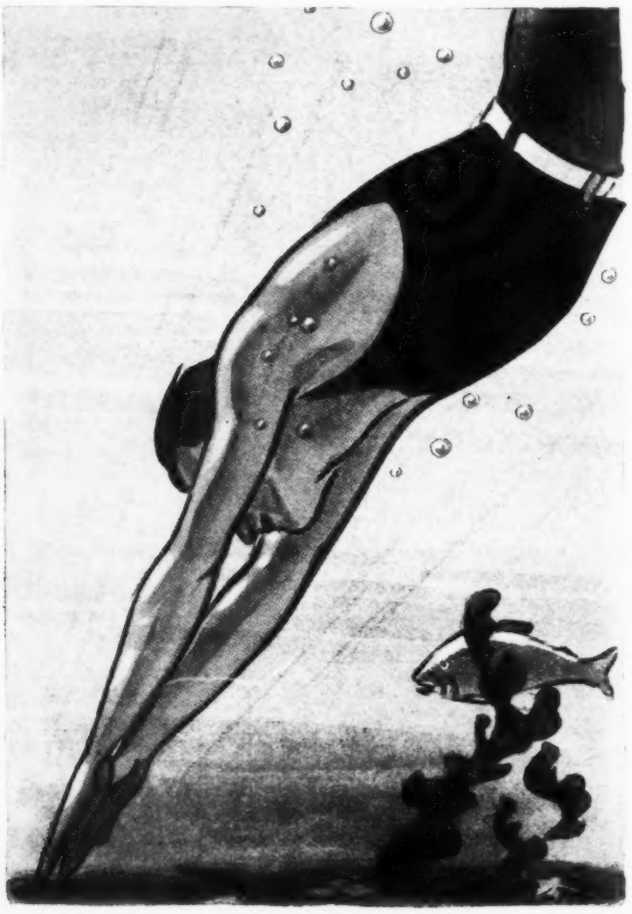
There are two double units and one single unit installed at the plant. The latter operates under 1000 pounds pressure and handles 220 barrels of oil per hour at 600 to 630 degrees F. The double units operate under 700 pounds pressure and handle 450 barrels of oil per hour at the same temperature. The oil is 20-24 A. P. I. gravity gas oil.

The pump case is made of cast steel. The cross-sectional drawing shows the mechanical construction of the seven-stage horizontal hot oil pump. The runners are placed back to back in pairs, with the odd runner taking care of the differential in pressure between the back of the runner and the front of the runner. There is only one stuffing gland used. It is on the low-pressure side and is entirely enclosed in a tight chamber. A steam smothering line is connected to the chamber to admit live steam in case of fire. Adjustments on the packing gland are made by means of the hand wheel on a spindle which enters the chamber through a stuffing box. On account of the temperature and flash point of the oil, any leakage would flash immediately in contact with air. The chamber around the packing gland protects the workmen and prevents fire.

The pressure on the stills is controlled by the speed of the steam turbine driving the pump, the speed being kept right by means of a sensitive oil governor on the turbine. Lubrication is effected by means of a force-feed pump which supplies clean, cold oil under pressure to the gland and blind bearing. The blind bearing metal is a lead alloy of such a type that it will stand very high temperatures without seizure. The blind bearing is water-cooled by means of a large water jacket cast in the casing. The gland is similarly cooled.



4" 7 STAGE HORIZONTAL HOT OIL PUMP



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Methods Used *to* Test Line Coating UNDER ACTUAL CONDITIONS

Ashes to ashes,
Dust to dust,
When we see you again
We hope you'll not be rust.

ꕥ ꕥ ꕥ

WITH that ritual or one of its variations, hundreds of painted nipples are being buried in nineteen different sections of the United States as a part of a study of pipe line coatings under the direction of the United States Bureau of Standards with the co-operation of the A. P. I. and paint manufacturers.

While such tests and the subsequent studies are expected to bring to light many enlightening features in connection with coating lines to protect them against corrosion, the plan has two primary objectives.

First of these is to study the life of bare pipe buried in soil with coated pipe under identical conditions. The second is to observe the behavior of buried painted nipples in relation to the behavior of painted pipe in a leaded line.

There is a wide difference in opinion relative to the difference in value of nipple tests and actual service tests. Many contend the nipples are not subjected to the same strains and stresses an actual operating line is and, consequently, those tests cannot be relied upon with a great deal of assurance.

Along with the representatives of several paint manufacturers Dr. Gordon N. Scott of the Bureau of Standards is supervising the nineteen main line tests in Pennsylvania, Illinois, Indiana, Kansas, Oklahoma, Texas, Louisiana and California. At each test site a section of main line is uncovered, cleaned, inspected and made ready for the test painting.

Nineteen various types of coatings are going into these tests. The pipe is marked in divisions and sections and each manufacturer is allowed one application in each division. The sections are measured off in 30-foot spaces, which are painted. The next 20-foot section is left bare.

A careful record is made of the conditions under which the application is applied along with the time consumed. When the coating is ready, instruments are used to measure its thickness and other data is obtained. The bare pipe is likewise closely inspected and all pit holes are measured.

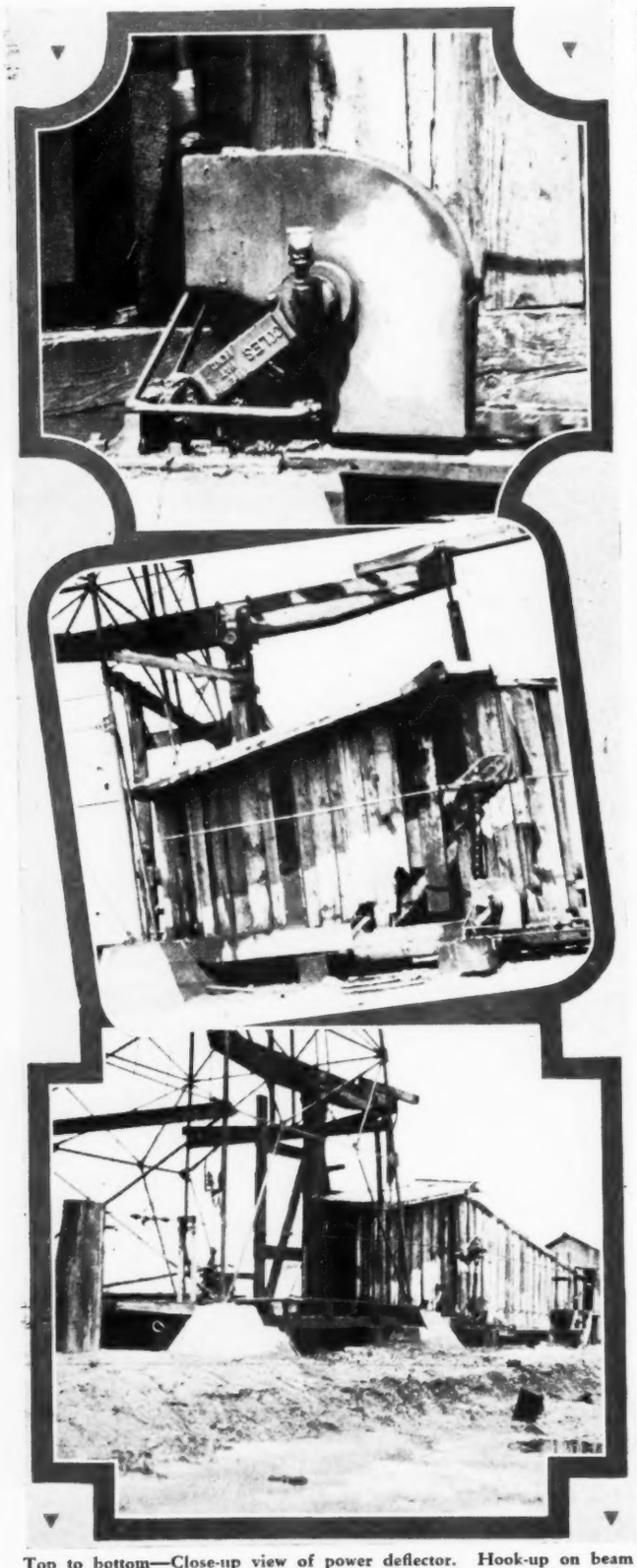
An apparatus designed to measure soil resistivity to electrical currents is also used. Samples of the soil are obtained and will be analyzed.

After all of the data desired concerning the soil, pipe and coatings, three long trenches are dug along the line for the burial of the nipples. Forty-six different coatings are represented in this test. And as this is the last phase of an usually hot and dusty job the above-quoted ritual is followed somewhat fervently and possibly earnestly by several.

The tests are designed to extend over a period of five and possibly seven years. Next year the lines will be uncovered and inspected. This procedure will be followed from time to time until completion of the study and tests.

Top to bottom—Dr. Gordon N. Scott, Bureau of Standards, and Floyd Waterfield, Jr., engineer, Oklahoma Pipe Line Co. The nipples in their "grave." A section of 10-inch main line on the Oklahoma Pipe Co. system, where one test is under way in $600-an-acre land.

Use *of* Deflector Adds Balance *to* Standard Rig



Top to bottom—Close-up view of power deflector. Hook-up on beam well, showing Pitman head and deflector. The entire installation at the beam well, showing powerhouse in back.

MAGNOLIA PETROLEUM COMPANY has converted a standard rig on its Thompson lease in the Davenport, Oklahoma, field into a balanced pumping power handling five wells on one 25-horsepower engine. This practice, which is an old one, has been improved through the adoption of a power deflector that prevents the racking of the rig and gives the power balance.

This deflector exerts a downward pull on the pumping strain, that pulls the shaft into place in its bearing and has a general gripping effect which has a tendency to steady the rig.

The deflector is set beneath a multiple pitman head on one of the sills. A rotary draw-works chain is connected to the pitman head running through the deflector to attach to one of the rod lines. Inside of the deflector is a sprocket wheel mounted on a swiveled yoke. The deflector is so constructed that the rod line from it may run to any well at any angle from the beam well.

The engine is installed similar to an individual pumping installation. It operates the beam on the well where it is located through an ordinary band wheel. The other wells are pumped through rod lines from the multiple pitman head, with one pumping through the deflector.

Each well is picked up on its pro-rata part of the band wheel revolution and the pumping strains are equally distributed throughout the band wheel revolution. The engine on the Magnolia installation is operating on about 165 revolutions per minute, while the band wheel revolves about 17 times a minute.

The installation was put in place last October and since this time has proven very satisfactory as a pumping method, and also a very economical installation.

The depth of the wells which are being pumped by this method is about 3,500 feet. The output is quite small at this time, and the wells make but little water. Four of the wells are pumped simultaneously, with the beam well in the third hole and the others on from 34-inch to 38-inch strokes.

When it is desired to pull the rods or tubing in the beam well the company uses a tractor for the purpose, the same as with the jack wells. Thus, the power is not shut down while the beam well is being serviced.

One of the wells pumping off this rig power is being pumped on the beam. This is accomplished through the use of a pulling mule, which is placed beneath the beam. This mule contains a sprocket-toothed wheel. A regular rotary draw-works chain runs through the mule, connecting at one end to the rod line and extends upward on the other end to the beam. The well is then pumped just exactly as if it were working on any rod line, however, the polished rod movement is the same as in pumping on the beam.

Stabilizing and Recovery Plant at
Continental's Baltimore Refinery

By L. S. GREGORY[1]

THE Continental Oil Company has recently installed and put into operation a stabilization and recovery plant at its Baltimore refinery. The installation debutanizes the pressure distillate and recovers and stabilizes the gasoline present in the refinery gases.

The refinery is located on the Chesapeake Bay and receives crude from tankers into its own tanks. At present the refinery is running Pecos County crude. The crude is run in a modern installation of reducing stills having a capacity of ten thousand barrels per day. The cracking side of the refinery consists of four five-hundred-barrel units and two two-thousand - barrel units.

Combined vapor recovery and stabilization plant.

Before the installation of the stabilization and recovery plant the refinery experienced a loss from rerunning and treating the pressure distillate as well as a loss of gasoline present in the cracking and reducing still gases. Therefore, it was decided to stabilize or debutanize the pressure distillate by means of fractionation and recover the gasoline in the cracking and reducing still gases by means of an absorption plant. It was desirable to recover all the pentane and heavier hydrocarbons in the gases and as much of the butane as could be blended in without producing a wild tank car gasoline. A survey of the blending stocks produced by the refinery indicated that a 90 per cent butane recovery could be satisfactorily employed if the extracted gasoline was practically propane free. Such a condition would produce a tank car gasoline containing a higher percentage of butane, but with a considerably lower propane content. This proposed tank car gasoline would not have a higher vapor pressure than produced in the past, but would possess the desirable feature of a higher volatility due to the increased content of butane with a corresponding decrease in propane.

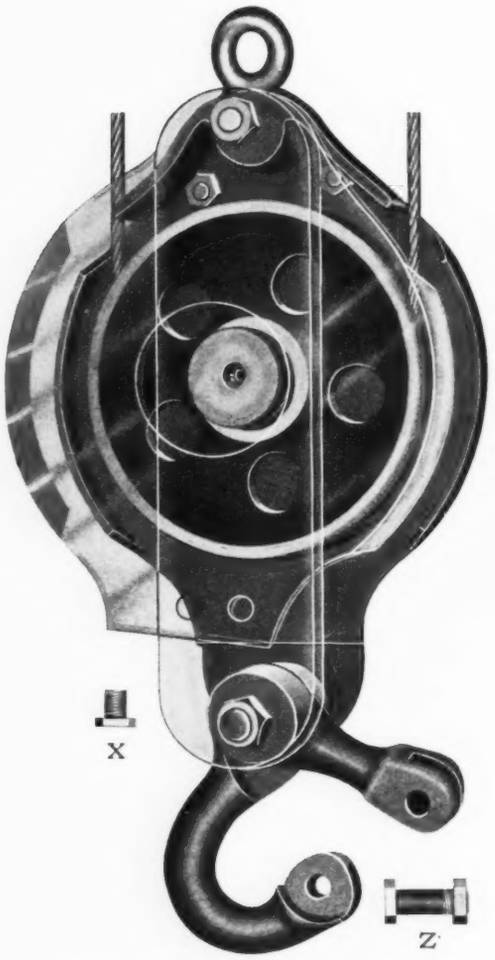
The accompanying flow sheet is the flow sheet of the stabilizing and vapor recovery plant. The temperatures and pressures shown are from actual operation.

The stabilizing or debutanizing unit is shown in the upper left hand corner of the flow sheet. The pressure distillate from the cracking units flows into the surge tank under its own pressure. From there it is pumped through heat exchange into the middle of the fractionating column. The debutanized pressure distillate is drawn from the base of the column, passed through heat exchangers with the pressure distillate entering the column, then water cooled and sent to the treating and rerun units. The vapors from the top of the column are cooled through a reflux condenser after which the condensate and residue vapors are separated in a separator. The residue vapors are introduced into the absorption plant under their own pressure. The level of the condensate in the reflux separator is maintained by means of a liquid level control which controls the amount of water to the reflux condenser. This insures a constant level or head on the reflux pump regardless of the load on the reflux condenser. The reflux is pumped back to the top of the column and the volume is controlled by means of a rate of flow control on the pump. The unit was designed to produce a debutanized pressure distillate containing less than 0.5 per cent butane. An inspection of the following analyses and Engler's distillations shows how effective the column is in removing the light fractions of the pressure distillate and thereby stabilizing the distillate.

	Pressure Distillate to Debutanizer	Stable Pressure Distillate from Debutanizer
Ethane	1.07%	.....
Propane	2.38	0.0 %
Butanes	7.38	.21
Pentanes	8.68	5.40
Hexanes	9.37	7.39

[1] Whealton & Townsend, Inc.

A SAFETY BLOCK THAT MEANS S-A-F-E-T-Y *all the time—in every way*



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U. S. Patent No. 17,211 and Others

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24″ Single Sheave	30″ Double Sheave
30″ Single Sheave	37″ Double Sheave
32″ Single Sheave	46″ Triple Sheave
37″ Single Sheave	46″ Quadruple Sheave

(All sizes are measured from end to end of side bars.)

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Peerless Load Binder and Jack.
Peerless Stuffing Box (Floating Type).
Peerless Speed Jack.
Peerless Bronze Sucker Rod Guide (Two-Piece).

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If it is necessary to use a *Safety* Block, why not use one that is 100% *safe* in operation and in handling? One that cannot catch fingers or foul the line?

The McKissick Safety Block fully meets every *safety* requirement. It is the standard of SAFETY in the oil industry.

Its construction positively prevents its use without the safety guards. The safety guards are as necessary to the operation of the block as the sheaves or the hook.

Fouling or catching of the line are eliminated with the McKissick Safety Block. Both the top and bottom beckets are completely enclosed. There is no way the line can foul or catch.

The sheaves are *all-steel.* The block is equipped with an oil reservoir which provides automatic lubrication and adds years of life to the bearings. The line grooves are machined to exact size.

SAFE AND EASY TO THREAD

To thread, simply remove set screw X as shown in the phantom view. This permits the safety guard plate to swing and open the line gaps. Place the line on the sheaves. The most simple threading safety block made.

To place elevator links or hook in becket remove bolt Z and open becket.

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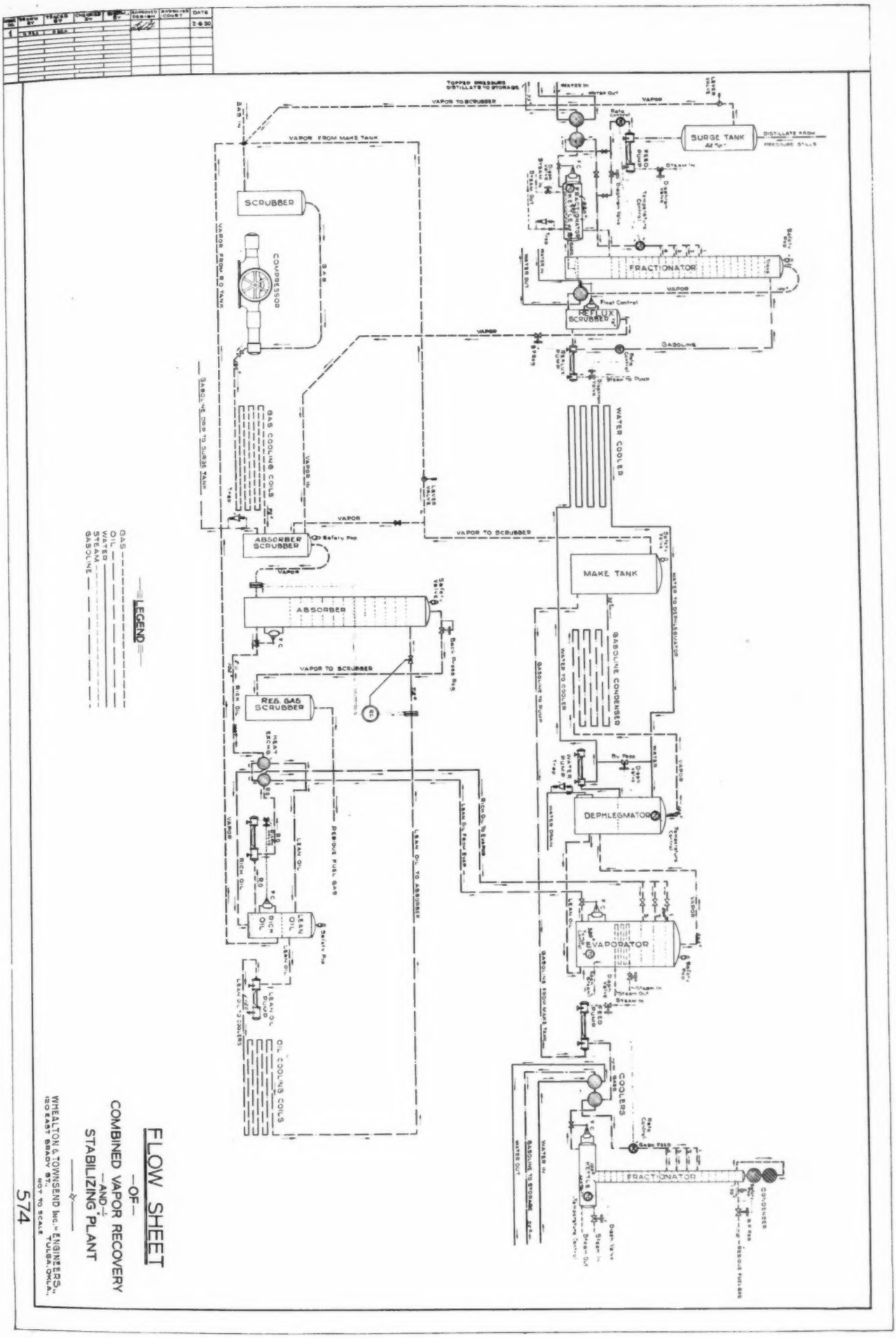

FLOW SHEET
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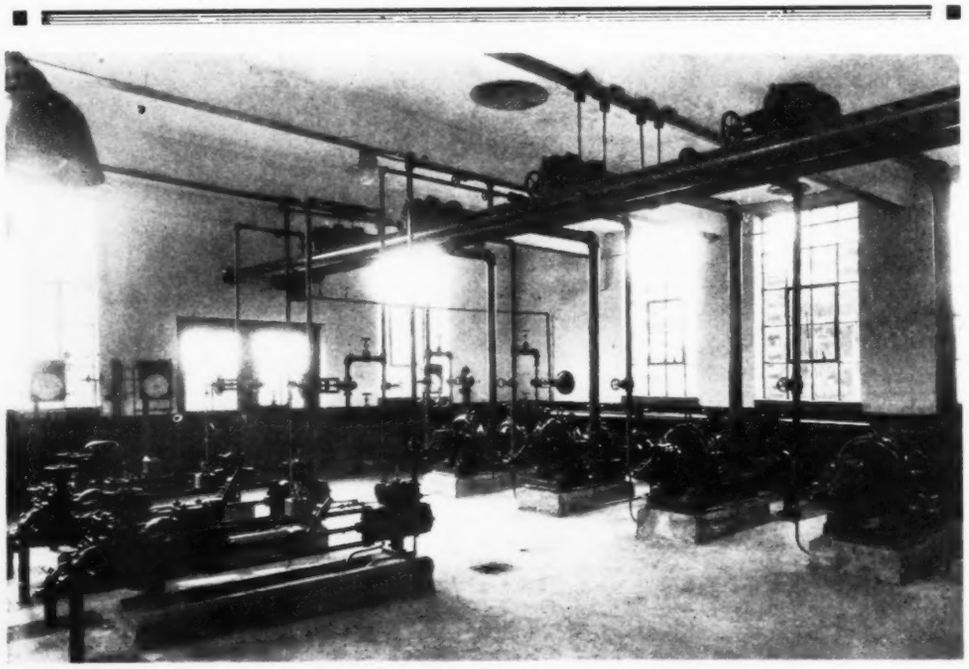
COMBINED VAPOR RECOVERY
—AND—
STABILIZING PLANT

WHEELTON & TOWNSEND Inc. ENGINEERS
TULSA, OKLA.
NOT TO SCALE
574

	Pressure Distillate to Debutanizer	Stable Pressure Distillate from Debutanizer
Heptanes and heavier	71.12	87.00
Gravity	55.4	49.5
Recovery	92.0	98.5
Residue	1.5	1.5
Loss	6.5	0.0
I. B. P.	90	128
10	160	197
20	188	232
30	252	260
40	278	286
50	309	310
60	335	338
70	364	364
80	408	392
90	476	430
E. P.	502	510

The unit was rated at 4,500 barrels a day, but has exceeded that capacity. The Engler distillation on the raw pressure distillate showed 6.5 per cent loss, while the debutanized distillate showed no loss; in other words, this distillate has but a slight volatility compared to raw product.

The pressure distillate is produced from Pecos crude and therefore has a high sulfur content. All hydrogen sulfide was removed from the pressure distillate by debutanization. It was found that the quantity of acid required to treat the distillate could be reduced in proportion to the percentage taken overhead in debutanizing, since this overhead requires no treating.



Pump room.

The pump house was made the control point of the plant. The gauge board was mounted in the pump house and carried all the important temperatures and pressures in the plant. The back pressure controls on the debutanizer and recovery plant stabilizer are also mounted on the gauge board. The rate of flow controls are mounted near the pumps and may be seen in the photograph of the pumps. The pumps on the right side are turbine driven centrifugal pumps, consisting of a pressure distillate feed, rich oil, lean oil, and standby pump. The line of pumps in the left are the reflux pump for the debutanizer, feed pump for the recovery plant stabilizer, and the reflux water pump for the dephlegmator.

The cooling coils consisting of the lean oil coils, gasoline condensers, reflux water coolers and gas coolers are bentube sections mounted in a spray pond. These coils are cooled by means of sea water.

The absorption plant shown in the flow sheet has four major sources of gas: the Cross, Dubbs, overhead gas from the debutanizer, and reducing still gas. The cracking and debutanizer gas entered the absorber scrubber under their own pressure. The reducing still gas is compressed, cooled, and introduced into the absorber scrubber. Recycled and vent vapors are mixed with the reducing still gas in the compressor suction scrubber. The vapors from the make tank are either delivered directly to the absorber scrubbers under their own pressure or sent to the compressor suction scrubber. The mixed gases pass from the absorber scrubber to the absorber and are stripped. The residue gas is metered and sold.

The oil rate is controlled by means of a ratio controller shown in the accompanying cut. By means of this control the gallons of oil per thousand cubic feet of gas to the absorber is maintained constant. This is highly important for economical operation in a refinery, due to the continual and often great variation of gas production from hour to hour. This variation in load required the absorption plant to possess a high degree of flexibility. In some instances the volume of gas treated by the plant changed from less than a million feet to over three million feet in a period of a few hours. The control mentioned above and other automatic controls permitted the plant to pick up this increased loading without more than the usual supervision by the operators.

The plant was designed to extract all the pentanes and heavier and over 90 per cent of the butanes. The average butane extraction over a period of a month was better than 95 per cent and in one instance the butane extraction ran as high as 98.8 per cent. The residue gas after this high butane extraction had a low specific gravity and a high B. T. U. value which rendered it very desirable for blending with artificial gas.

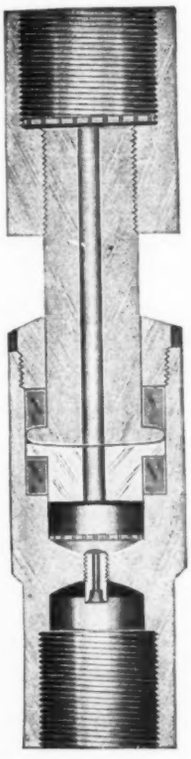
The plant at full load, 4,500 barrels/day pressure distillate and 3,000,000 cubic feet/day gas, used approximately 950 G. P. M. water and 11,100 pounds steam per hour. Under load the production of debutanized pressure distillate and unstabilized recovery plant gasoline was approximately 3,950 barrels/day and 34,000 gallons/day, respectively.

The plant was designed and installed by Whealton & Townsend, Inc., Tulsa, Oklahoma.

Fishing Tools Drilling Tools

AMERICAN IRON & MACHINE WORKS CO. · OKLAHOMA CITY ·

for Perfect Performance — American Tools



Flexible Coupling for Rock Bit Lubricator

The lubrication on the rock bit is protected by the American Flexible Coupling for Rock Bit Lubricators. With this flexible connection between the watercage and lubricator, danger of breaking off the lubricator is prevented.

The flexible coupling will maintain your lubrication and save many a round trip. It protects against ruined cones and lost drilling time.

Bushing

The American Rock Bit Breakout Block is the original and only tool of its kind ever offered to the drilling industry.

Fits your rotary table. Holds the bit firmly in place while breaking joints. This means speed and safety for the men on the rig.

With this tool you have protection against losing or damaging rock bits while breaking joints. It eliminates damage to side reamers or breaking your tongs.

Rock Bit Breakout Block

AMERICAN IRON & MACHINE WORKS CO.

Manufacturers of Oil Field Equipment

Oklahoma City, U. S. A.

AMERICAN OIL FIELD EQUIPMENT

American Releasing and Circulating Overshots
American Rock Bit Wrenches
American Milling Shoes
American Flexible Coupling for Rock Bit Lubricators
American Steel Tool Houses
American Steel Tool Boxes
American Forged Steel Wall Hooks
American Rock Bit Breakout Blocks
American Paraffin Bits
American Forged Steel Drill Collars
American Female Die Nipples
American Releasing and Circulating Spears
American Tapered Taps
American Forged Steel Subs
American Rotary Shoes
American Cone Fishing Baskets
American Steam Lubricators
American Side Tracking Mills
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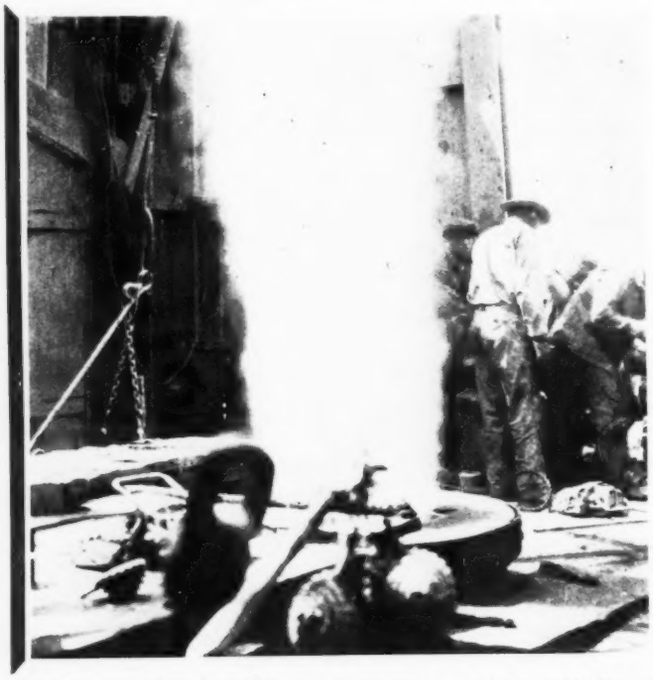
American Steel Engine Foundations
American Automatic Cathead
American Automatic Cathead Control Levers
American Rotary Milling Tools
American Myracle Sucker Rod Sockets
American Surface Bit Blades for Rock Bits
American Drill Pipe Float Joints
American Pump Manifold Check Valves
American Eccentric Releasing Overshots
American Casing Suspension and Blowout Preventers
American Lead Plugs
American Rock Bit Cone Fishing Sockets
American Steel Whipstocks
American Inside Pipe Cutter for Drill Pipe or Casing
American Adjustable Steel Rig Braces
American Fish Tail Bits
American Pipe Rackers

When writing American Iron & Machine Works Co. *please mention The Petroleum Engineer*

Method of

Gauging Gas Wells Without Open Flow

CONSIDERABLE attention is being devoted to the method of measuring the available flow from the gas producers in the Oklahoma City field. This method, which has been worked elsewhere, applies to Oklahoma City, especially because of the big wells and large pressures. It requires no open flow to determine the amount of gas pro-



duction permitted under state statutes, and in addition to preventing wastage of gas, does away with the idea of possibly having to contend with a wild well due to the cutting of sand carried out with the flow. Also there is no pipe friction to cut the flow, as apparent in several other methods of gauging gas wells.

The system adopted by one of the principal operating companies is termed the 90 per cent pressure gauge method. Explained simply: the rate of flow of gas from the well is measured while the well is operating at a settled pressure equal to 90 per cent of the shut-in rock pressure. The daily volume at this rate of flow is called available gas. It has been found that the average well in Oklahoma will probably show a 90 per cent pressure gauge to give a volume close to 25 per cent of the open flow.

The means of using this method in the Oklahoma City field has been to hook up the wells into the line through a meter. Two wells are on each line at the same time, one of which is shut in to build up rock pressure, while the other handles the load. When the shut-in pressure is reached, a 90 per cent of the rock pressure calculation is made by simple mathematics. This 90 per cent pressure is held as a working pressure on the well by allowing gas to flow from the well through a choke nipple or a pinched gate. Most wells can be produced in this manner through the meter at the well and the gas will go into the line without waste into the air.

In about ten or fifteen minutes with the gate pinched, the well can be "settled" at this 90 per cent working pressure and the delivery measured either on the meter at the well, or through some other measuring device. This measurement completes the gauge of the well and normal operation can be resumed. The skeleton of the plan is to determine 90 per cent of the shut-in pressure and measure the delivery while the well is working at that percentage pressure.

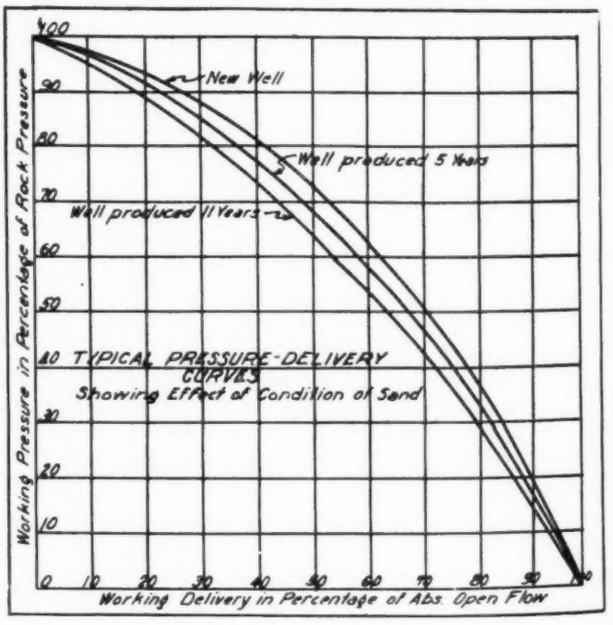
The Indian Territory Illuminating Oil Company has found this a most satisfactory means of obtaining the 25 per cent flow measurements on the largest wells in the Oklahoma City field, some of which have 200,000,000 cubic feet of gas.

By permission of the Osage Indian Agency, which regulates oil and gas operations in Osage County, Oklahoma, the Indian Territory Illuminating Oil Company, has had several wells in this county which have not been pulled below their working pressure since 1926, while open flow elimination methods were being tried. This company has approximately 200 gas wells in the county.

With this background and after hundreds of tests, the company, in December, 1928, adopted the 90 per cent Pressure Gauge method as a means of completely eliminating open flow of gas wells. Most of this research work has been conducted by Herbert F. Beardmore, petroleum engineer of the Indian Territory Illuminating Oil Company.

The gas is measured by this system at the normal flow conditions in a sand. If a well is to be operated at low velocity flow, the gauging should surely be done under similar conditions. Flow conditions in a gas sand are much different at low velocities than at high velocities, yet restrictions on a high velocity open-flow basis have heretofore been used for controlling the delivery at the low velocity operating conditions.

Restrictive regulations on well deliveries are for the protection of gas sands. These restrictions have always been made on a volume basis because the gauging method was



on a volume basis, yet the fundamental principle of the restriction was to control pressure differential.

A brief code for making a 90 per cent pressure gauge is as follows:

1. Record working pressure well.
2. Clean fluid from well.
3. Shut well in and build up to rock pressure.
4. Calculate 90 per cent of rock pressure.

Example of calculation:

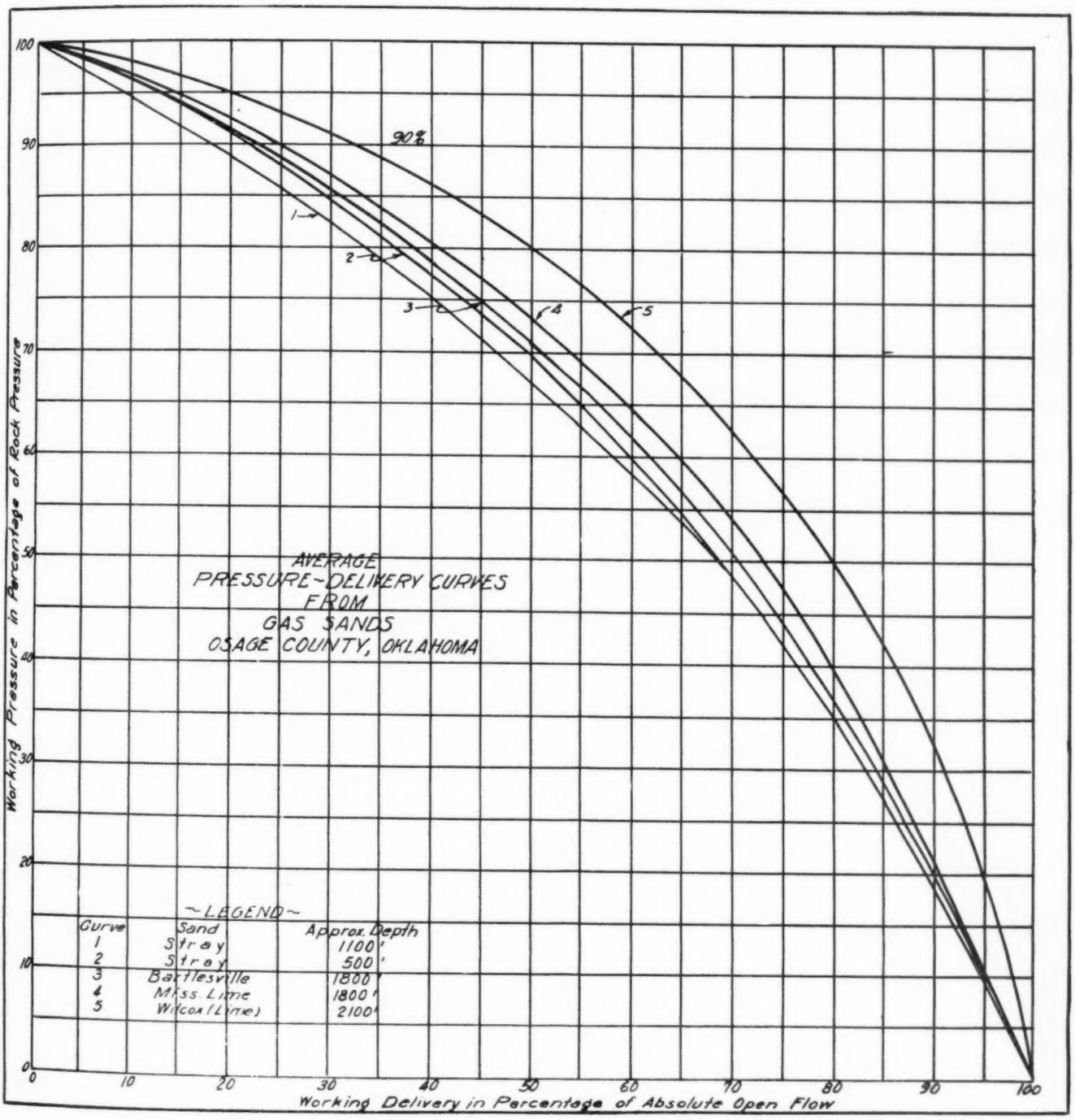
615# Rock Pressure.
615#+15#=630# Absolute R. P.
630#×.9=567.0# Absolute 90% R. P.
567#—15#=552# Gauge 90% R. P.

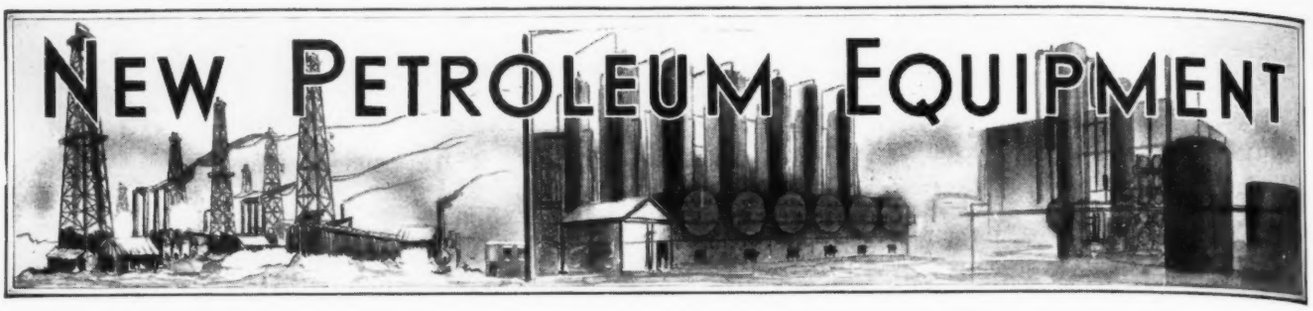
5. Produce well through choke-nipples, orifice discs, or pinched gate at a rate of flow which gives a working pressure on the well equal to the 90 per cent pressure determined in 4. Get a steady operating condition at this pressure. (A settled pressure should be reached in from five to fifteen minutes.)

6. Measure gas coming from the well:
   A—Through meter in line, or
   B—Through orifice prover, or
   C—With pitot tube.

This question of measuring gas has been of foremost interest to the gas industry during the past few years. The open-flow method of gauging gas wells has long been accepted, but with the realization of the injury to a gas well flowing open, as well as the wastage of the method, has given operators a desire of eliminating this method.

Most results have been various curves whereby a well's open-flow volume is approximated from the decline in rock pressure, or charts on which the open flow can be computed from a delivery measurement at a high working pressure.





Hills-McCanna Liquid Sampler

A MEANS of obtaining an accurate, composite sample of practically any fluid, quickly and easily, is offered in the Hills-McCanna liquid sampler. Samples from three levels of tanks or tank cars are obtained in a single operation. Even the extreme bottom of the vessel is reached.

It has found wide use in all types of plants handling large quantities of bulk petroleum and vegetable oils, paints, dyes, tar, acids, etc.

The sampler operates on the single plunger suction principle. It consists of a hollow metal cylinder 13½ inches long, made of non-sparking metal. A close-fitting piston without packing operates the inner wall of the cylinder.

Instructions for operating are quite simple. Further details and copy of the bulletin giving specifications may be obtained by addressing the Hills-McCanna Co., 2349 Nelson St., Chicago, Ill.

Monarch Pitman and Counterbalance

THE Monarch Derrick Company, 317 Central State Bank Building, Tulsa, has announced the Monarch pitman and counterbalance with a new principle and new design.

The pitman is constructed of 5⅝-inch, 20-pound pipe. It has a two and one-half inch A. P. I. standard stirrup, which is adjustable for any length jack posts or sampson posts. The lower casting for weight suspension and bearing housing is electric steel, electrically welded to pitman.

A wedge adjustment on the babbitt bearing, with three-eighths-inch take-up, insures tight bearing and long wear, according to the makers. The pitman pipe is used for oil reservoir, holding many days' supply. Sight feed lubricator, with needle valve adjustment, assures positive lubrication of wrist-pin bearing.

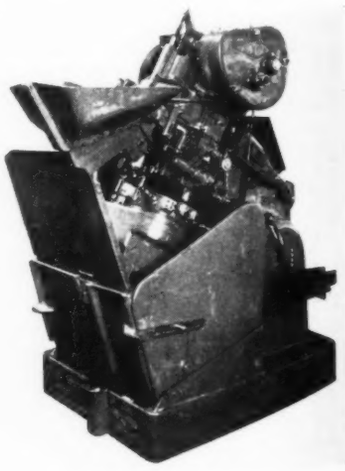
The counterbalance is of dovetail design of large castings, eliminating shearing strain on bolts and reduces vibration. The counter weights are quickly removed by detaching turnbuckle braces and removing nuts on two main bolts, allowing weights to rest on blocking set on walk. Main bolts quickly lift weight assembly back into pumping position.

Sinclair Buys Electrical Equipment

THE Sinclair Refining Company, Wellsville, New York, has purchased for its new power house, the following equipment manufactured by the Westinghouse Electric Company of East Pittsburgh, Pa., according to the latter company: Two 750 kw., 80 per cent power factor, 2,300-volt, 3-phase, 60-cycle generators with embedded thermocouples for measuring internal temperatures and with direct connected exciters; two h. p., 327 r. p. m., 2,200-volt, 3-phase, 60-cycle, 80 per cent power factor, type HR synchronous motors for driving air compressors; two motor-generator sets to provide field excitation for the above-mentioned motors; two 175 h. p., 328 r. p. m., 220-volt, 3-phase, 60-cycle, 80 per cent power factor, type HR synchronous motors for driving air compressors; two motor-generator exciters for these motors; two magnetic, full voltage starters for the 17 h. p. motor and complete switching equipment for this apparatus.

New One-Inch Automatic Forming and Threading Machine

A NEW one-inch automatic forming and threading machine has been developed by the Landis Machine Company, Waynesboro, Pa., to meet the demand of bolt manufacturers who require an automatic machine for threading bolts and screws in one-inch diameter. The capacity of this new one-inch machine ranges from one-half to one inch in diameter. It will handle bolts and screws up to 6 inches in length, any length of thread up to 2½ inches and any style of point.



Many new features have been incorporated to make it a faster, safer and more accurate machine than the present Landis ¾-inch unit.

Features of this new automatic forming and threading machine insure a full thread at the start, an accurate lead and a minimum amount of taper. This machine employs a special 1⅞-inch Lanra head of the pull-off type, equipped with Landis long life chasers.

Full details of the many new features of this machine may be obtained from the Landis company.

Lucey Type E-6500-A "Quad" Oil Bath Swivel

THE new Lucey type E-6500-A "Quad" oil bath swivel is equipped with four heavy-duty roller bearings, each designed specially for the particular duty to which it is adapted.

The upper thrust bearing is a ball bearing, designed exclusively for upward thrusts. Its construction makes it especially adaptable to the use of pull-down devices used when spudding in or drilling at shallow depths, according to the Lucey claims. The main load bearing is a tapered roller bearing designed specially for swivel duty. This giant bearing is designed for a load of 365,000 pounds at 100 r. p. m. Two American heavy-duty roller sleeve type bearings absorb all radial thrusts and relieve all other bearings of this duty. These bearings rigidly align the swivel stem and minimize wear on all packing and packing glands.

The large swivel body has an oil capacity of 10 gallons and is braced at the top by the swivel bonnet, which is of exclusive Lucey design. At the point where the bonnet presses into the body is a projection of considerable proportion. The outside diameter of this projection is accurately machined. The bonnet forms a brace across the top of the body, which is believed to eliminate the liability of the body crushing under sudden severe shocks. The swivel bail and trunnions are oversize and the bail is forged from a solid steel billet, carefully machined at the point where the trunnions pass through it, so as to insure straight hanging of the swivel. All stuffing boxes are unusually deep, providing an abundance of packing. The gooseneck is extra heavy and bends at a 20-degree angle. The gooseneck has full three-inch opening for fluid, as does the swivel.

Cook's Graphitic Iron Has Big Sales

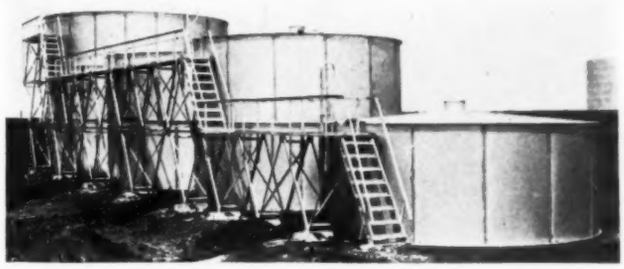
G. LEE COOK MANUFACTURING COMPANY of Louisville, Ky., reports that they will furnish the 57-1,250 horsepower Worthington gas engines recently purchased for the Amarillo-Chicago pipe line with the required piston rings and metallic packings of Cook's Graphitic Iron.

A substantial share of the piston ring and rod packing business on the 24-1,000 horsepower engines recently bought from the Cooper-Bessemer Corporation by the Empire Company will also be furnished by this company, as will the same materials on 16-700 horsepower gas engine compressors bought by the Phillips Petroleum Company from the Worthington Company.

Unusual Storage Tank Runways and Stairs

A NEW and improved runway and stairway for storage tanks, that is proving popular in the Oklahoma City oil field, has been designed by engineers of the Columbian Steel Tank Company of Kansas City, Mo.

It employs the same principle as a child's Erecto building outfit and lends itself ideally to oil field use as it may be



extended as long or as high as desired, changing elevations upward or downward as conditions require.

It is made up of interchangeable angle iron sections, each of which is 90 inches long and 30 inches wide with a diagonal brace. In building the runway the sections are bolted together by means of hexagonal gusset plates.

Louis Allis Opens New Sales Offices

THE Louis Allis Company, manufacturers of direct and alternating current motors, of Milwaukee, Wis., has opened three new sales offices. With the opening of these three offices Louis Allis has offices in practically all important petroleum centers.

Following are the new offices and the men in charge:

C. O. Sargent, 1715 Union Bank Bldg., Pittsburgh, Pa.

W. Woobank, 215 B East Archer St., Tulsa, Okla.

A. R. Thomas, 4441 Santa Fe Ave., Los Angeles, Cal.

Ehlinger Advertising Buys Plane

STANLEY J. EHLINGER Advertising, with general offices in the Commercial Building, Tulsa, has recently purchased a new Stinson-Detroit cabin monoplane powered by Lycoming motor. It is a sister ship of the famous plane

that recently established a new world's record refueling endurance flight of 23 days in Chicago.

The plane, with a cruising speed of over 100 miles per hour, will enable this agency to maintain contact with its clients at distant points.

Clark Trucwelder

THE Clark Trucwelder is a complete, mobile, self-contained, gas-powered, electric arc welding unit, capable of 24 hours' continuous operation and especially useful in places and on work where there is no convenient source of electric power, according to the claims of the manufacturers. The Trucwelder takes the welding equipment to the work.

The unit is equipped with self-starter and headlights, carries all necessary welding accessories, has ample room

for acetylene tanks, seating room for crew and ample power for towing trailers.

Arc welding current, ranging from 60 to 250 amperes, at 25 volts, is developed by a self-excited G. E. arc welding generator with control, driven by a special heavy-duty, four-cylinder gas engine developing 20 horsepower at 1,480 r. p. m. Currents between 25 and 60 amperes may also be obtained by inserting in the circuit a current-reducing resistor provided for the purpose. The current available is ample for use with all commercial sizes of metallic electrodes from $\frac{1}{16}$-inch to $\frac{3}{16}$-inch, also for light carbon welding and cutting.

Engine and generator are connected by a three-inch wide endless special composition belt. Generator is thrown in and released by a hand-controlled belt tightener—a ball-bearing idler mounted on sliding ways, located on driver's platform to the right of the driver.

Automatic stabilizing of the welding arc is provided for by a self-adjusting arc stabilizing reactor. The reactor makes it easy for the operator to maintain a steady arc on low as well as on high currents, under all welding conditions.

The Trucwelder, which is made by the Clark Tructractor Company, Battle Creek, Michigan, conforms to the specifications of the U. S. Bureau of Standards, meets the requirements of the U. S. Navy Department for arc welders and is listed as standard by Underwriters Laboratories.

Jackson Engineering Appointed "Unipulvo" Distributor

THE Jackson Engineering Corporation announces a new connection as sales representatives for the "Unipulvo" unit pulverizer manufactured by the Strong-Scott Manufacturing Company, Minneapolis, Minnesota. The "Unipulvo" is an underfed unit pulverizer designed for the efficient utilization of petroleum coke, coal, or lignite for boiler fuel. The sales rights include the entire petroleum industry and exclusive rights for the states of Oklahoma, Texas, Arkansas and Louisiana.

New High-Temperature Stack Paint

THE Standard Oil Company of New York, Paint Department, is now offering No. 1560 Socony high-temperature stack paint to the market. This paint requires a temperature of approximately 500 degrees to set it properly. When properly applied and set, it is designed to withstand temperatures exceeding 1,000 degrees. One coat will be found sufficient, but the paint should be well brushed out to insure good adhesion, the manufacturer states.

Emsco Mid-Continent Crown Blocks

THE Emsco Derrick & Equipment Company of Los Angeles, Cal., has published Bulletin No. 40, describing and illustrating its Type GB and Type EB Crown Blocks for drilling in the Mid-Continent oil area. These two blocks are intended primarily for use in the Mid-Continent and wherever the Mid-Continent system of drilling is used. Both crown blocks are of heavy structural steel. Specifications are fully listed.

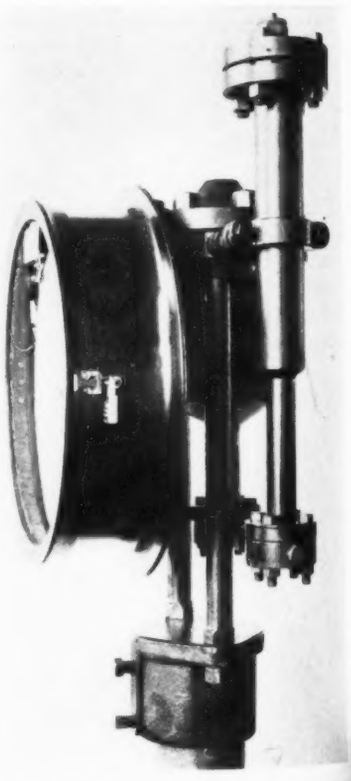
American Tank Company Changes Name

THE American Tank Company of Oklahoma City has announced a change in its name; henceforth it will be known as The American Tank and Equipment Corporation. A new factory has just recently been completed, and so much equipment, other than tanks, will be made that it was deemed advisable to include this fact in the company name.

This company is one of the manufacturing units of Black, Sivalls & Bryson, Inc., of Bartlesville, Okla.

Two New High Pressure Foxboro Flow Instruments

THE Foxboro Company of Foxboro, Mass., has just brought out a new high-pressure recording meter and flow controller. The new instruments are built for operating pressures of 2,500 pounds per square inch.



If static readings are needed a two-pen instrument with static element is furnished. When total flow readings are desired an integrator can be supplied on the instrument.

The new flow meters and also the new flow controllers can be mounted in place without the use of loading devices.

All parts of the new instruments are specifically designed for high pressure applications. All working parts are drop forgings. They retain all the features that have been incorporated in Foxboro orifice meters.

HOUSTON

than

MANY users of fabricated piping located in the areas naturally served by the Midwest plants at St. Louis, Los Angeles or Passaic may anticipate no benefit from the recent establishment of a similar Midwest plant at Houston. They are apt to regard the Houston plant as of interest only to the Southwest.

The fact should not be overlooked that the addition of the Houston plant enables all Midwest plants to offer the obvious advantages and economies of operating on an even larger★ scale. It also makes possible additional development to improve piping practices and more extensive research to anticipate the piping requirements of tomorrow—work that a smaller company could not profitably undertake.

Regardless of his location, the user of fabricated piping will find it is now more advantageous than ever before to use the Greater Midwest Piping Service.

★ *The combined pipe fabricating capacity of the four Midwest plants far exceeds that of any other organization in the country.*

MIDWEST PIPING & SUPPLY COMPANY, INC.

MAIN OFFICE—1450 So. Second St., St. Louis

Chicago
208 S. La Salle St.

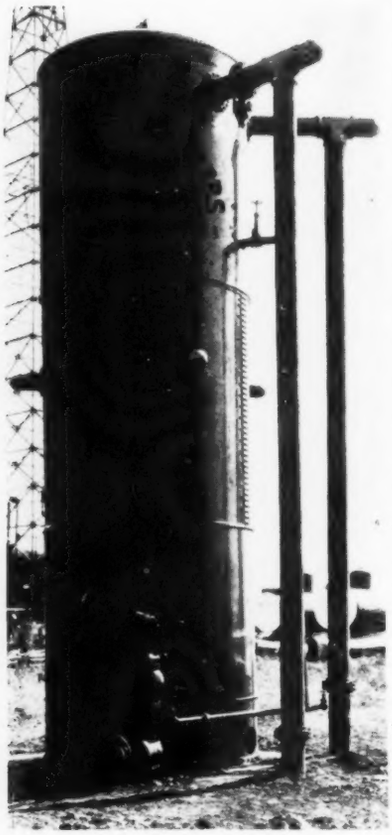
Los Angeles
520 N. Anderson St.

New York
(Ballwood Division) 30 Church St.

Houston
600 Bringhurst St.

Tulsa
733 Mayo Building

Hanlon-Waters Separator Announced



HANLON-WATERS, Inc., Tulsa, Okla., has announced its separator. The one illustrated is in service in the Oklahoma City field, located on the Sinclair Oil and Gas Company's School Land 69, well No. 1.

The Hanlon-Waters separator is designed on a new principle, which enables it to efficiently handle very large capacities of oil and gas with the same size tanks, that have become more or less standard in oil field practice.

The separator is constructed in accordance with the A. S. M. E. code, with a safety factor of five or the usual lighter construction with a safety factor of three. Separators are available in all sizes, ranging from 3x10 feet to 7x23½ feet, and from all pressures up to 500-pound gauge.

A New Consistometer

A NEW instrument that has been devised by the Bureau of Standards' men is a consistometer. A very comprehensive article on the new consistometer and its application to greases and to oils at low temperatures has been prepared by Ronald Bulkley and F. G. Bitner.

It is a rugged, simple instrument, speedy in operation, that can be employed for either opaque or clear materials of a wide range of consistencies. It also possesses two features which are unusual in a consistometer, but which are of great importance. The first of these is that the test material may be passed successively back and forth through the capillary any number of times. The second is that determinations of the rate of flow are made by passing only a very small volume of material through the capillary, thus minimizing the effect of the working which is incident to the measurement itself.

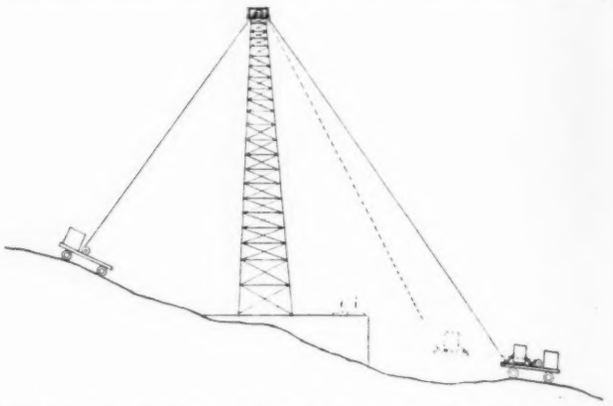
The consistometer permits the taking of any number of flow-pressure graphs at the same or different temperatures without refilling or removing from the bath. It can be used to measure either the unworked or the worked consistency of plastic materials of any temperature.

This interesting pamphlet may be secured from the Bureau of Standards, Washington, D. C.

Handling Material in the Oil Fields

THE accompanying sketch shows a case of ingenuity in handling material in the oil fields. A General Electric drilling control unit was being trucked to the derrick, which was situated on a slope. The ground was loose and the truck could not get through.

The drilling contractor's trucks were equipped with winches operated by the truck drive. One truck, stationed

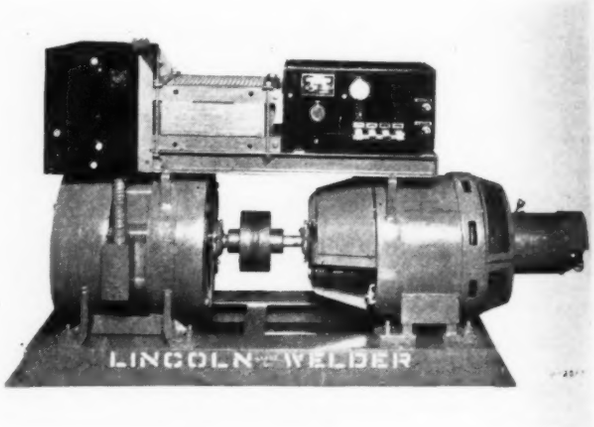


farther up the slope and on the other side of the derrick, ran a cable up over the crown block sheave and down to the second stalled truck, where it was fastened to the control equipment. A second cable, from the stalled truck, was connected to the other side of the control. The machinery was then slung through the air and landed on the derrick platform. Men with timbers steadied the unit in its transit to the platform.

New, Larger Welder

A NEW welder with a rating of 600 amperes has recently been announced and placed on the market by The Lincoln Electric Company, Cleveland, Ohio, manufacturers of "Stable-Arc" welders and "Linc-Weld" motors.

This new welder may be had in either the portable truck type or stationary truck type. It is a motor-driven, single-operator, variable voltage machine and has a current range

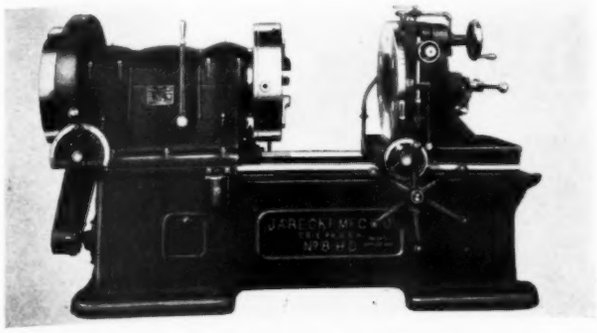


of from 180 to 750 amperes. The motor and generator are direct connected. The working mechanism of all controls are contained in a ventilated enclosed steel cabinet with hand regulators and switches mounted on a panel which forms a side of the cabinet.

The use of a combined voltmeter and ammeter, known as a volt-ammeter, makes possible the reading of amount of voltage and amperage on one dial and eliminates the use of the separate ammeter.

New High Speed Threading Machine

THE Jarecki Heavy-Duty Threader has been developed by the Jarecki Manufacturing Company of Erie, Pa. The eight-inch model in this new high-speed threader gives an average threading speed of over 29 feet per minute—



and cuts off eight-inch pipe at the rate of over 100 feet per minute, according to the claims of the makers.

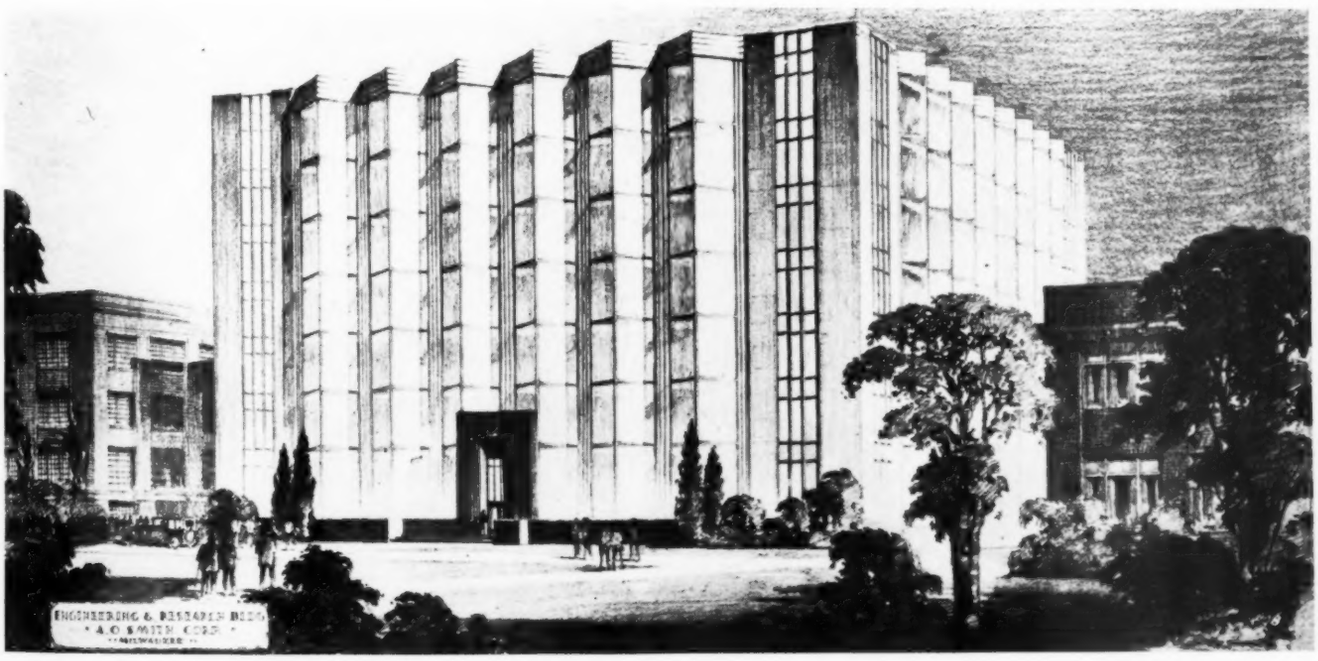
An automatic self-opening die-head assures exact duplication of threads on each run. A forged steel trigger, extending inside the die-head, automatically opens the dies when the correct length of thread has been cut. This trigger is quickly set for any length of thread desired by means of a thread length dial on the die-head which is calibrated in one-quarter inches and for Briggs standard. The trigger recedes completely out of the way when the chasers are open, returning to position again when the chasers are closed. When desired, the chasers can be drawn back by hand independently of the automatic opening device.

Chasers for the eight-inch machine are two and one-quarter inches wide, providing ample width for cutting an eight-inch standard thread, which is 2.1 inches long. To speed up the changing of chasers when changes in thread pitch occur, the new Jarecki chasers are firmly clamped in three directions in the large steel holders by means of one screw. The operator uses only a screwdriver in taking out the tapered screw which clamps the chasers.

It is not necessary to change chasers to thread any size pipe within the regular range of the machine, two and one-half inches to eight-inch, nor is it necessary to change die-head when changing over the machine to pipe of different sizes.

A gear-driven reversible pump forces 16 quarts of oil to the die-head per minute. Streams of oil bathe the cutting points of the chasers at all times. The nine-inch spindle bearings are lubricated positively by means of a chain which brings oil from the reservoir.

A. O. Smith Corporation Has New Laboratory



THE first of the manufacturing units of the A. O. Smith Corporation, of Milwaukee, to command the attention of industry, was the automatic frame plant, a unit that is as nearly 100 per cent automatic as it is economical to make a factory. The designing of the plant and its intricate machinery centered on the elimination of human handwork. It is, by today's standards, machine perfect.

At the other extreme a unit centered solely on the work of men will be found in the engineering and research building, a seven-story building now under construction.

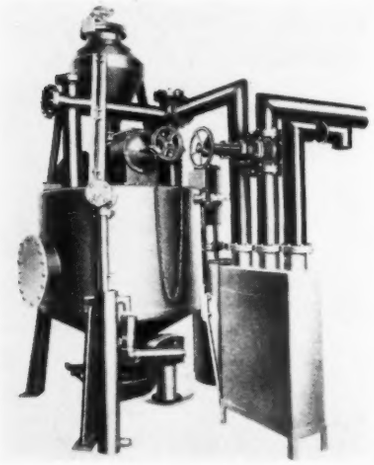
But the production will be that of men's brains, not their hands. Here, in this latest addition to the A. O. Smith institution, the scientific human element will find its greatest expression.

Eventually one thousand men, carefully selected research engineers and scientists will carry on this work of invention and discovery with facilities the like of which every research man has dreamed about, but few have ever even hoped to see as actual working conditions.

This staff of engineers and scientists will be built up by the addition of more hundreds of men to the many hundreds now with the organization—a force that already records among its achievements the development of the revolutionary pipe mills, automatic frame plant and the welding plants of the A. O. Smith Corporation, as well as many contributions to the scientific information and working principles of the industries that the company serves.

Oxweld Type NA-3 and NA-4 Acetylene Generators

OXWELD ACETYLENE COMPANY, 30 East 42nd St., New York City, has placed on the market two improved types of non-automatic stationary acetylene generators for supplying large volumes of acetylene. These generators are each made in two sizes, having 500-pound and 1,000-pound carbide capacity. They are designed for large industrial plants where oxwelding and cutting are used extensively and where oxygen and acetylene are piped to stations convenient to operators.



Oxweld Type NA-3 acetylene generator.

The Oxweld Type NA-3 acetylene generator, shown in the illustration, is for plants using low-pressure welding and cutting apparatus and delivers to a storage holder which is weighted to supply acetylene to the shop piping system at a pressure of 20-inch water column.

In operation, the carbide is conveyed from the hopper to the generating chamber by a rotary feed screw driven by a slow-speed reciprocating water motor. The screw, being cast nickel, is very resistant to wear and will not cause sparks.

From the generator the gas enters the wash box where it passes through a water seal which acts as a scrubber to remove any particles of residue which might have been carried over. This device supplants the felt or hair filter usually employed. It has the advantage that it cannot clog and cause abnormal back pressure or insufficient delivery to the holder.

Merco Nordstrom on Production With New Valves

MEETING what they claim to be the highest pressure tests ever made in the oil and gas industry in so far as valves are concerned, the Merco Nordstrom Valve Company is on production with the manufacture of Venturi series lubricated valves that are subjected to hydraulic tests ranging to 6,000 pounds. These high-pressure valves are made of cast steel and embody the "Sealdport" principle of lubrication, which is said to be one of the latest developments in valves. The Venturi valves range in pressure tests from 150 pounds up. The 150-pound valves are subjected to a primary air test of 75 pounds, a secondary air test of 150 pounds, and a hydraulic test of 300 pounds. All of the valves manufactured under the Nordstrom name are subjected to tests twice their rated capacity. An engineer for the concern states that the hydraulic test is intended to prove valve resistance to rupture primarily and is made on valves with both ends blanked off and the plug in cracked position. Where the hydraulic test required exceeds 500 pounds the valve is tested with water pressure on both sides of the plug and in closed position. The hydrostatic pressures, according to a Nordstrom engineer, are doubled the rated cold working pressures in practically all of these lubricated valves.

Laboratory Equipped for Special Problems

DR. E. H. LESLIE and Dr. H. B. Coats announce the engagement of the Leslie Laboratories of Traver Road, Ann Arbor, Michigan, in a service including physical, chemical, and engineering research and development work, and also general laboratory work, in the fields of distillation, chemical treatment, dewaxing, and the various processing operations of the petroleum refining and natural gasoline industries.

Brown Instrument Increases Plant

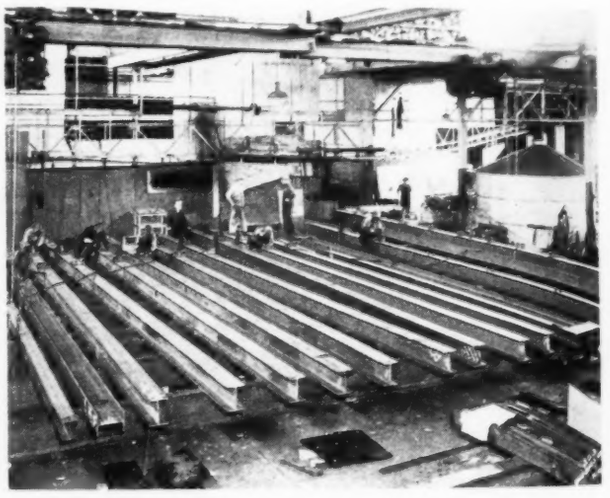
THE Brown Instrument Company, Philadelphia, Pa., manufacturers of Brown pyrometers, flow meters and other industrial instruments, has let a contract for 40,000 square feet of additional floor space to its plant.

This company has also published a new catalog on Brown electric flow meters with new data and new ideas. It is a ninety-page illustrated booklet on developments and applications.

New American Tank Factory

THE new factory of the American Tank and Equipment Corporation, formerly American Tank Company of Oklahoma City, has been completed and is in operation. This company, a subsidiary of Black, Sivalls & Bryson, Inc., of Bartlesville, Okla., will, to a marked degree, specialize in welding, although some riveted work will be done.

The new factory of the company has been all welded constructed, each member of the framework being welded together. Only three rows of columns support the structure. While this factory is the biggest shop of its kind west of Chicago, this welded building is one of the very few and



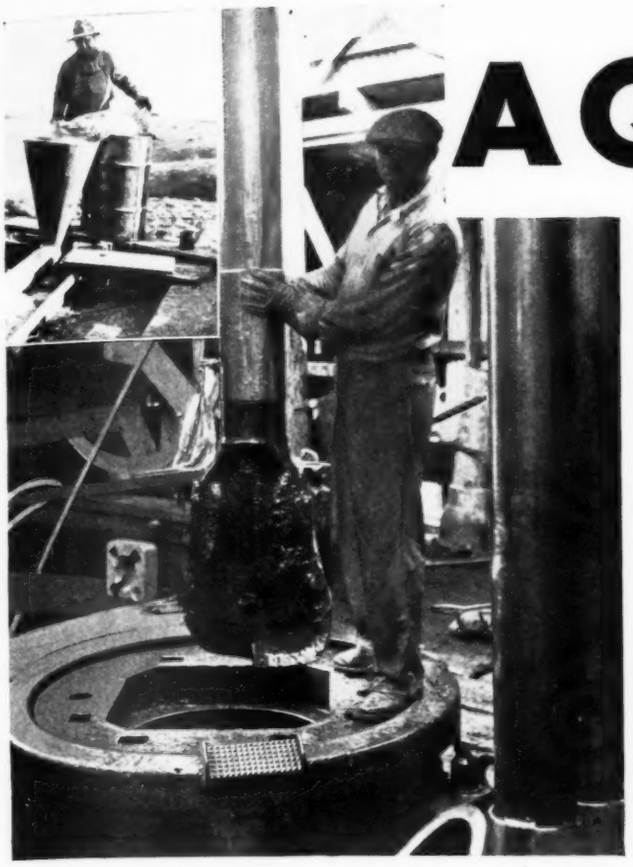
largest in the country, there being others in Chicago, San Francisco and New York.

The plant is fireproof. It was built in six weeks, half of which time was spent in welding the framework.

The fabrication of the spans was done in the Kansas City plant of Black, Sivalls & Bryson Manufacturing Co.

Adjoining the factory building is being erected one of the largest heat treating furnaces—80 feet long, 13 feet wide, and 18 feet high. This will be used to anneal or heat treat the heavy vessels that have been welded so as to equalize stresses and assure full strength of the metal.

The production of this plant will be on a continuous line and built on the principle of the larger automobile factories. A railroad track at one of the buildings facilitates handling.



AQUAGEL prevents stuck bits and drill pipe.

AQUAGEL

THE MOST EFFICIENT DRILLING MUD ADMIXTURE

The addition of 2% to 3% by weight of AQUAGEL to any drilling mud converts it into an ideal transporting and sealing medium . . . Efficient drilling muds can be made by mixing AQUAGEL and any non-abrasive earth . . . Cuttings—as large as wheat—are removed from the bottom of the hole as rapidly as they are disengaged from the formation . . . Sloughing and cavings are prevented by the plasticizing action of AQUAGEL.

THE CAUSES OF STUCK DRILL PIPE ARE REMOVED AND FASTER, SAFER DRILLING IS ASSURED.

The lubricating features of AQUAGEL-treated muds reduce replacements of slush pump parts to a minimum . . . a saving great enough to buy all the AQUAGEL required.

AQUAGEL is manufactured and marketed under patents and pending patents of the Silica Products Company of Kansas City, Missouri, from our Los Angeles and Osage, Wyoming plants.

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When writing CALIFORNIA TALC COMPANY *please mention The Petroleum Engineer*

New Design of Oil Storage Tank

A NEW type of oil tank has been developed by the Chicago Bridge & Iron Works of Chicago, Ill., for the storage of volatile liquids under pressure. It is called the Hortonspheroid because of its unusual spheroidal shape.

In order that there should be as little tendency as possible for the tank to change shape, and so as to reduce the amount of steel reinforcements, the tank has been in a spheroidal shape with a flattened bottom. The bottom, shell and roof form a more or less continuous curve.

The Hortonspheroid installation for Waggoner Refining Co., Electra, Texas.

An experimental installation was made in June, 1928, in Chicago. This structure was first built without stiffeners of any kind and subjected to structural tests.

With no liquid in the Hortonspheroid, compressed air was put in and the pressure increased gradually until a vertical buckle appeared in the lower portion of the shell. Then the pressure was relieved and liquid load alone supplied until a horizontal buckle appeared around the circumference just above the ground level.

Observations made during these tests indicated the stiffening necessary and a girder was placed around the base of the structure. It was then filled with water and five pounds of pressure applied and relieved 500 times, or the equivalent to a year's service.

The experimental Hortonspheroid was filled to within about two feet of the top with water on September 8, 1928, and 700 gallons of gasoline pumped in on top of the water. The Hortonspheroid was closed and a continuous record kept from September 8th to October 20th of the changes in pressure by means of a recording gauge. The internal pressure never exceeded five pounds, indicating no evaporation loss from the vent which was set to open at that pressure.

The Chicago Bridge & Iron Works has published a booklet, entitled "The Hortonspheroid", which describes this new type of storage tank. These booklets may be obtained without charge by addressing the company at Chicago, Ill.

Webster Engineering Company New Distributors

THE Natural Gas Equipment, Inc., Los Angeles, has announced that effective on July 1 the Webster Engineering Company, Tulsa, became sales and service distributors of Wilgus Gas Pressure Regulators and N. G. E. Gas Burners in all Mid-Continent territory. The Tulsa office of Natural Gas Equipment, Inc., has been combined with the Webster Engineering Company. V. E. Ready and Julian Monax will continue to serve N. G. E. customers as members of the Webster organization.

The Chicago Bridge & Iron Works has opened a new sales office in Tulsa in charge of D. A. Leach, formerly of the company's New York office.

This new office, which is the fourth one the Chicago Bridge & Iron Works has opened since the first of the year, is in the Exchange Bank Building.

Capacity Charts for Fisher Specialties

THE Fisher Governor Company of Marshalltown, Iowa, has published a pamphlet giving capacity charts for the Fisher specialties. These charts have been prepared for the convenience of the company's customers and representatives. By the proper use of these charts an accurate estimate of the capacity of any Fisher specialty may be made. These charts and data are based on exhaustive tests made in the Fisher research laboratory. This pamphlet may be obtained by writing to the company.

Macco Opens Mid-Continent Offices

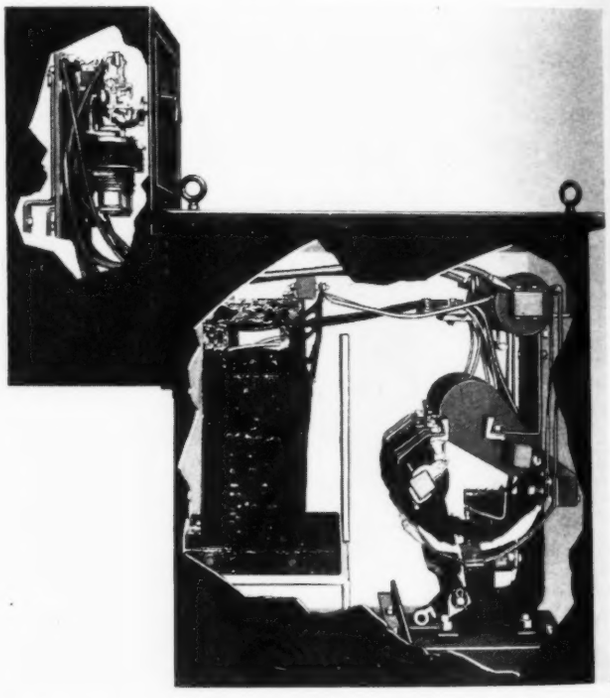
MACCO CONSTRUCTION COMPANY, with headquarters in Los Angeles, has opened offices at Oklahoma City, with T. W. Selser as Mid-Continent manager.

New Full Voltage Magnetic Starter

A NEW 2,300-volt, full voltage magnetic starter is being built by The Electric Controller & Manufacturing Company of Cleveland, Ohio.

This starter, complete with overload relays and self-contained potential transformer (to secure 220 volts for control circuit), is intended for across-the-line starting of squirrel cage and synchronous motors and may also be used to control the primary of slipring motors. The starter is built for reversing, non-reversing and plugging applications.

The design of this starter is different from the switchboard circuit breaker type of starter. There are no boll

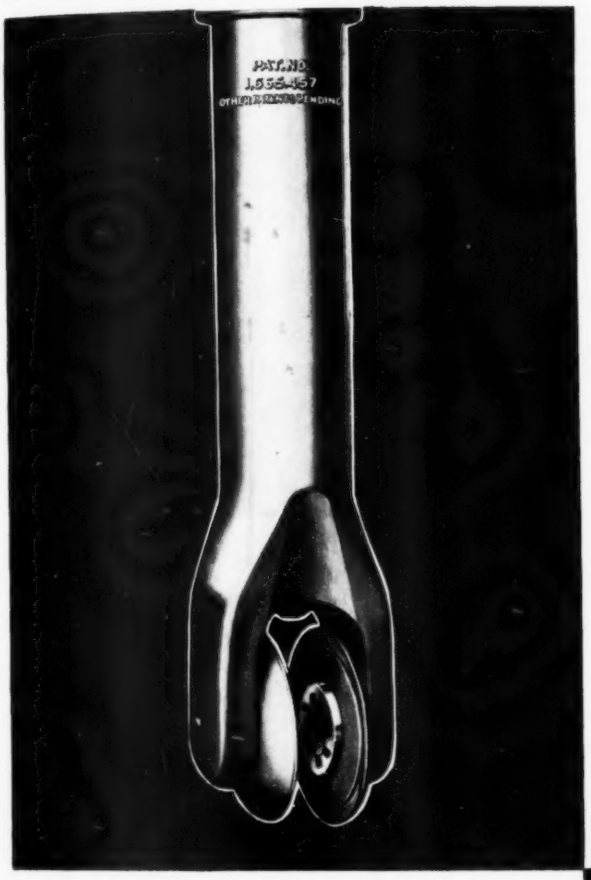


cranks, toggle mechanisms or lever systems between the magnet armature and movable contact arm. The magnet armature, carrying the movable contact arm, is direct acting and is supported by only one large bearing pin, and, since the entire unit is totally oil-immersed, all working parts are always well lubricated and protected from dust and corrosion.

The contacts used on this, the type ZHS full voltage magnetic starter, open and close the circuit with a wiping and rolling action, are duplicate and are easily renewable.

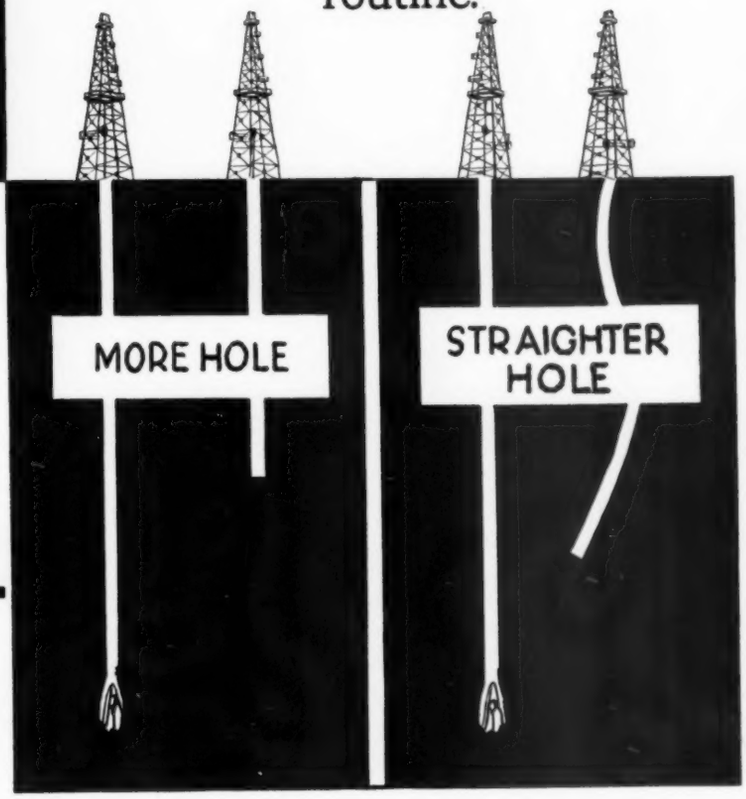
Not a record ▲▲▲just everyday performance▲▲▲

1647 feet* *with one set of discs!*



BJ DISC BITS

have established a reputation for digging more hole and straighter hole, so that performance like the above is accepted as part of the daily routine.



* This run was made at Venice, California, with a BJ 17″ Plain Shank and 13″ Discs, in sand and shale formation. The hole was *less than 1 degree off vertical.*

BYRON JACKSON CO.

Established 1872

General Offices: 2150 East Slauson Ave., Los Angeles, Calif.

Tulsa Houston New York City

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When writing Byron Jackson Co. *please mention The Petroleum Engineer*

CAPACITY OF » » » » »

Mechanical Giants Speeds Equipment Hauling

IT WAS not many years ago that practically all of the hauling in the oil fields was done with teams and wagons, that, at the best, could handle but a very limited load when compared with the tremendous capacity of our present mechanical hauling giants—powerful trucks with trailers, and tractors.

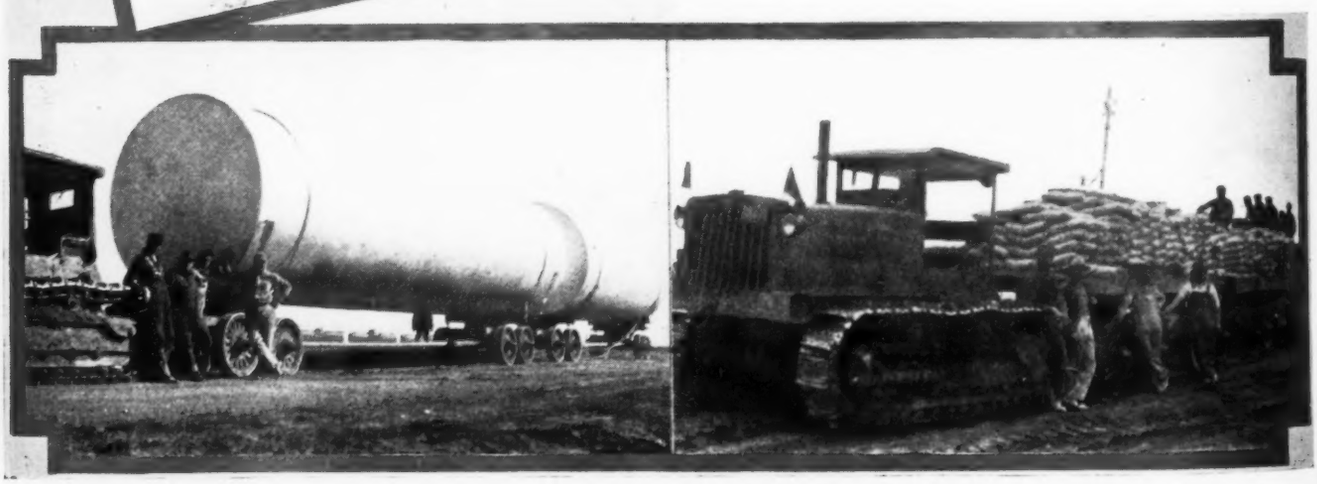
Perhaps, as little thought has been given to this indirect, but still important, branch of the oil industry as to any other from an improvement standpoint. Consideration of the very large loads handled by these machines, and of the very small loads the old horse and wagon would have been able to transport—for instance, one slush pump weighing about 20,000 pounds and other equipment weighing as much as 50,000 pounds, impresses upon one the important part that such equipment plays in field work.

These powerful giants of the road dodge in and out among derricks many times each day, without ever attracting a glance from the nearby workers, with loads that would have taken many trips a few years ago.

In a number of ways these improved facilities for transportation have reduced the loss of much time in moving equipment to the various locations. The slow time of the horse is surpassed many times, while the increased hauling capacity reduces the number of trips and would increase the time savings to a surprising figure.

The horse and wagon have practically become a thing of the past in the oil fields. Even in rainy weather, with the road slick and slimy with mud, trucks and tractors continue to make their way around. Occasionally one will become stuck, but another easily lifts it out and sets it on its way again.

In one of the accompanying pictures a tractor is shown hauling 650 sacks of cement on two eight-wheel wagons. This was all the cement required for the cellar and foundation at a new location in the Oklahoma City field. The other pictures also show some big hauls in the Oklahoma City pool.



Top to bottom—Loffland Bros.' 7½-ton White truck carrying boiler. A. C. Clark's truck, equipped with Spencer trailer, hauling absorber to Phillips natural gasoline plant at Oklahoma City. I. T. I. O. tractor hauling 40-by-10-foot tanks to natural gasoline plant at Oklahoma City. I. T. I. O. tractor carrying 650 sacks of cement at Oklahoma City.

SOME ROTARY TOOLS

By

HONEST TOOLS

HINDERLITER

ROTARY STANDARD CABLE

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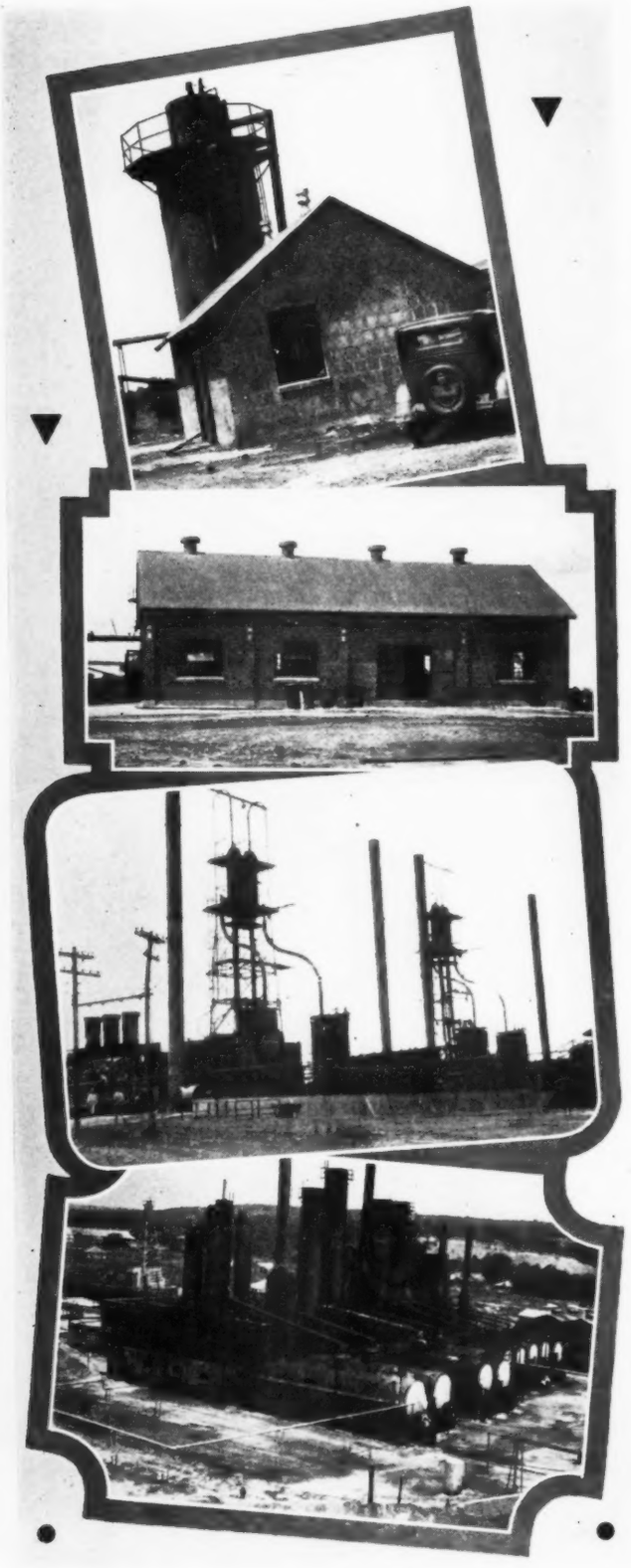
Johnson Refinery HAS NOVEL FEATURES



Top to bottom—Water treating plant. Power plant. Cracking units. Crude oil stills.

THE Johnson Oil Refining Co.'s refinery located at Cleveland, Oklahoma, is running about 5000 barrels 39 A. P. I. gravity crude per day. The process consists of reducing Oklahoma crude to about 26 A. P. I. gravity and cracking the topped crude in two Dubbs units.

The finished products include ethyl gasoline, U. S. motor gasoline, kerosene, furnace oil and fuel oil.

The crude distillation units include a battery of shell stills, each equipped with a fractionating tower for the efficient fractionation of the various light oil streams. The reduced crude is then charged to the Dubbs units. Dubbs residue is fired under the stills and boilers.

Treating

The cracked gasoline is treated with sulphuric acid and caustic soda, then sweetened with sodium plumbite. All the gasoline in the plant is treated in a continuous closed treater. The kerosene is treated and sweetened in a batch agitator.

Recovery Plant

All of the vapors from the stills and the storage tanks are collected in a vapor recovery system and the gasoline recovered in an absorption type plant. This plant produces about 2000 gallons of stabilized gasoline per day.

Water Treating

The water for the refinery is obtained from the river and from three shallow wells. The well water is used on the condensers and cooling coils. It has a constant temperature of 65 degrees F.

The boiler feed water is treated with lime and sodium aluminate and filtered through layers of sand and gravel.

Power Plant

The electric power used at the refinery is generated by two 250 KVA generators run by steam engines at 125 pounds line pressure.

Loading Rack

A very modern loading rack having a capacity of fifty tank cars has recently been completed. During the hot summer weather all gasoline and light oil loading is done at night to reduce evaporation losses. In loading cars a line goes to the bottom with a T on the end. After the depth of the gasoline has reached three inches the surface of the liquid is not agitated.

Laboratory

A chemical research laboratory under the direction of Frank P. Frey, chief chemist for the company, has done much work in the solution of treating problems of both the gasoline distillate and the water used for the plant. In addition to the research work, all the products and plant processing is checked by this department.

Ethyl Gasoline

This refinery was one of the first in Oklahoma to blend ethyl fluid with its gasoline. The proportion of this grade gasoline has been continually increasing during the past year. Due to its higher anti-knock rating, the treated cracked gasoline from the Dubbs distillate is used to produce ethyl gasoline.

THEY PACK A PUNCH

SPANG LONG-STROKE JARS

SPANG
The Higher
CABLE TOOLS
Standard
SPANG SPANG SPANG

Jars that make excellent joints—jars that last longer—jars drop-forged *without welds* from a single piece of alloy steel, specially heat-treated and tempered—SPANG Long-Stroke Weldless Jars—stocked by over 300 leading supply stores!

SPANG & COMPANY
BUTLER, PA.

SPANG

▼ WELDLESS JARS ▼

When writing SPANG & Co. *please mention The Petroleum Engineer*

International Petroleum Exposition Shows Large Expansion

The automatic pipe line pump station at the Exposition.

LIKE Faraday's dynamo, which impressed the great Gladstone as a trifling toy, a world-changing idea may have the humblest beginning — but when its worth is established, the Niagaras, harnessed by Faraday's genius, are not more lasting.

The analogy between Faraday and the men who opened the first International Petroleum Exposition in a roped-off street of Tulsa, in 1923, becomes clearer as events connected with the oil show in 1930 are unfolded.

Obviously, the emphasis, in a history of the Exposition's rise to world-wide influence, is not to be placed on the fact that the intrinsic value of the oil show has grown to $10,000,000 from the original valuation in 1923 of less than $5,000. What is of far greater importance is the collection of data which demonstrate the Exposition's full acceptance by all of the important associations connected with the petroleum industry in every oil producing land.

However, the plant of the "World's Fair of the Oil Industry" is well worth describing, so, noting first the additions made in the twenty-five per cent expansion program this year, there is given here a sketch of what this year's 200,000 visitors will see, October 4-11.

The 1930 Expansion program is nearing completion this month at a cost of approximately $200,000. This sum does not include the enlarged and improved automatic pump station which is valued at $85,000. The Marketers & Refiners and the California buildings, each 240 feet long and 60 feet wide, are the largest items. Two lineal miles of cement sidewalks line the buildings and the newly-opened "outside" spaces. To inspect all of the displays the visitor will now be obliged to walk more than five miles over walks and floors.

Other new buildings are: A structure housing the branch offices of the Postal and Western Union Telegraph companies, and the United States Postal depot. A new lunch bar 90 feet long and an annex to the present cafeteria. An annex to the administration building. A large, fenced-in nursery building where mothers may leave their children with a trained nurse. A hospital for emergency cases.

The day's mail; Harold Davis at bat.

To supply the electric current required by the 1,500 exhibitors there is a total length of wire exceeding 1,000,000 feet. The total length of gas lines is 75,000 feet. The water lines also total 75,000 feet. The sewerage lines, placed end on end, would extend 25,000 feet. As an indication of the number of people interested in the oil show, a computation of the total

length of paper sheets enclosed in one mail to the entire field recently gave a figure in excess of eight miles.

The wide range in the oil show displays has on one end the tiny and extremely delicate electro-magnetic instrument used in estimating the mass of an atom, and on the other end the towering steel derrick equipped with a rotary unit for reaching depths of 8,000 feet. Between these extremes are 200,000-pound cracking stills, complete miniature operating refineries and natural gasoline manufacturing plants, powerful ditching machines, spudders, winches, trucks, Diesel engines, fishing tools, welding equipment, pipe-wrapping machines, and thousands of other interesting displays.

The automatic pipe line pumping station recently completed by the American Society of Mechanical Engineers for presentation during the Exposition has aroused the interest of the industry in all parts of the world. This station is located just east of the Marketers and Refiners building and is not to be considered as a model. It is an operating station such as one would see in the field, with pumps, tanks, valves, piping and the rest. However, it is equipped with instruments to be operated and controlled automatically. In this station the engineers have brought out an unusually complicated arrangement, because all of the operating features of three different types of stations are included. This has been done because the station is intended for research work. It has, therefore, especial educational value. The remote control feature will be demonstrated when the station is operated from a downtown hotel. It is important to note that this station automatically makes correct adjustments in case of leaks in the line, high temperatures, unusual gas conditions, and any other emergencies.

The United States Bureau of Mines, Bartlesville Experiment Station, has been working upon a control laboratory for operating leases, and announces that its first laboratory of this type will be given its premier showing in the scientific and technical building at the oil show. Days of delay are eliminated by the installation of these laboratories in the oil fields, Bureau officials say. Among its uses will be for the prompt solution of analysis problems arising in cementing jobs, mud fluid, gas conditions, emulsion and water.

The associations connected with the industry, such as the American Petroleum Institute, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the Petroleum Geologists' Association, the Mid-Continent Petroleum Association, the Natural Gasoline Manufacturers' Association, the petroleum division of the National Credit Men's Association, the geological surveys of a score of states, and numerous other groups, are perfecting their plans for participation at the Exposition.

The international aspect of the Exposition and Congress was early given emphasis by the signing by President Hoover of the joint resolution in June which authorizes the President to invite representatives from fifty-two foreign nations to the oil show congress. These invitations have been presented through diplomatic channels from the offices of the Secretary of State, and hundreds of acknowledgments have come to the Exposition offices in Tulsa.

The American Express Company, official transportation agents for the Exposition and Congress, in co-operation with the White Star Line, is carrying out an active publicity campaign to interest European oil men in the Exposition. The American Express Company has arranged an itinerary which opens with embarkation at Southampton,

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for stopping any thread leak at tee, elbow, flange, gate, coupling or master gate under any pressure or temperature.

The Skinner Pipe Joint Clamp stops the leak at its source on gas, oil, steam, water or hot oil. Strong, sure and permanent. Can be put on under pressure. In universal use in the oil and gas industry. Made of malleable iron.

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Buckeye *Wheel-Type* . . . . . Ditchers Preferred

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Wheel-type ditchers as built by Buckeye now, and for over 30 years, offer many exclusive advantages. Included in their distinguishing mechanical features are: Accurate grading ability, producing a clean, finished trench; *all-steel* construction; heavy, substantial main frame; slow-speed, industrial type motor; the rugged digging wheel which made Buckeye famous; multiple digging speeds, quickly shifted; Alligator (crawler) wheels with traction brakes; and strictly one-man operation.

There is a *wheel-type* Buckeye for every pipe line ditching requirement. Cutting widths range from 11½" to 40" and depths to 7½'. *Service* Backfillers and *Utility* Backfiller-Cranes are efficient, profitable companions for these ditchers.

Ask for our attractive and interesting new catalog, "BUCKEYE—*The Pipe Liner*". It contains specifications, working views and performance data of special interest to all pipe line engineers and contractors.

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September 24, on the S. S. Olympic, and closes at the same place, October 25, after an eight-day visit at the Exposition, a tour of the principal oil fields and visits to the large industrial centers of the United States. The cost to passengers is 157 pounds, two shillings and six pence.

In accordance with their annual custom the railroad systems of the United States, Canada and Mexico are making arrangements for a reduced fare schedule for the benefit of travelers to the oil show. The two rate classifications are the regular return trip fare and the "fare and a third," with validation required from the oil show management.

Exhibitors will have the advantage of free return of their freight when this freight is rerouted over the original carrier. This advantage is regulated by a slight modification in connection with the freight zones crossed on long hauls.

To expedite handling of freight upon arrival in Tulsa, the Consolidated Transfer Company has been formed by the Tulsa Terminal, Joe Hodges and Red Ball companies.

The "scissors and paste-pot" department.

With the equipment of all these companies at the Exposition's disposal, the exhibitor can expect prompt delivery of his materials to the display space contracted.

Because the Exposition and Congress holds an unique position in the petroleum and gas industry, it is unrestricted by a necessary observance of narrow policies. To this fact is to be attributed the unusual freedom given to speakers at the oil show's open forum in the new auditorium building. In the open forum any problem or question, however radical or reactionary, is given equal status in controversy with the most orthodox propositions. Any minority may be assured of a place to present its side of any matter.

The opening program of the oil show is always an outstanding affair, as is indicated by the fact that the 1927 Exposition was formally set in motion by President Coolidge; the 1928 show by an address by the Hon. Charles M. Schwab, chairman of the board of the Bethlehem Steel Corporation and of the Chicago Pneumatic Tool Company; Edwin B. Reeser, president of the American Petroleum Institute, gave the opening address in the 1929 Exposition. A pleasing surprise in the formal opening program is promised by President Skelly this year.

Prospective visitors to the "World's Fair of the Oil Industry" are advised to make their hotel or apartment reservations early.

Unusual Oklahoma City Cement Job

OPERATORS in the Oklahoma City field have experienced considerable trouble in attempts to plug back producers by cementing, due to the great pressures that have often outweighed the cement to the extent that the latter has either been forced up in the tubing or up the outside between the tubing and the casing.

C. E. Wright, petroleum engineer, Indian Territory Illuminating Oil Company, recently tried an interesting and unusual means of controlling this action. Wright had a check valve placed one joint up on the two-inch tubing. After forcing the predetermined amount of cement into the hole, a two-inch wooden plug was dropped into the top of the tubing, through an open gate, and jabbed past the cement hose line connection. Pressure from the cement pump was then used to force this plug down to the check valve, which was supposed to stop its downward move and prevent the cement from raising up in the tubing.

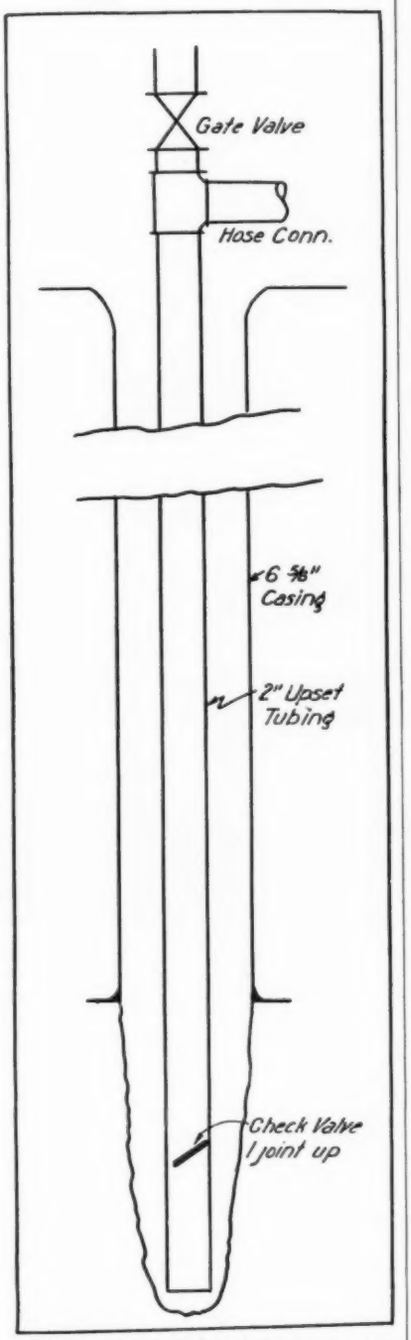

Diagram drawing of hook-up on cementing job by Indian Territory.

When the wooden plug reached the check valve and the pressure began to build up against the pump, the latter was immediately stopped. The fluid used for forcing the wooden plug down to the check valve was clean water. General opinion of engineers in the pool is that this simple method should prove effective against permitting the pressures to force the cement up into the tubing.

The deepest oil well, located in the Midway field of San Joaquin Valley, California, is nearly 10,000 feet deep. The original Drake well was 69 feet.

More than 26,000 oil wells were drilled to completion in the United States in 1929, with 15,500 producing oil, 2,900 gas and 7,600 dry holes.

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QUARTER CENTURY OF BUILDING SCREENS

THE LAYNE
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The "greater production" *Layne Milled Groove Screen*, —oil industry's latest, greatest and most important invention—is the fruit of more than a quarter century's experience in solving screening problems.

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The *Layne Milled Groove Screen* is your definite guarantee for greater production —no clogging with mud and sand, no sand cutting—and it has the strength to safely stand 8,000 feet of drill pipe.

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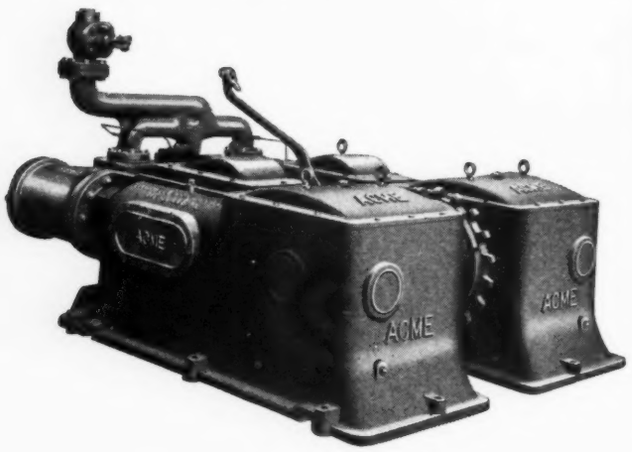

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TIWG9

Taubman Supply Corporation Opens Two Branches

HERMAN TAUBMAN, president of the Taubman Supply Corp., has announced the opening of a new branch at Hobbs, New Mexico, and also a branch at Hugoton, Kansas, center of the Western Kansas gas field. This is in line with the Taubman policy which has always been to establish a branch in every important oil and gas center in order that Taubman 24-hour service might be available.

This announcement from Mr. Taubman comes as the firm celebrates its tenth year of continuous and faithful service to the oil and gas industry. From one small location in Tulsa, the Taubman Corporation has grown until it now has branches at Oklahoma City, Seminole and Konowa, Oklahoma; Borger and Wink, Texas; Wichita, McPherson and Hugoton, Kansas, and Hobbs, New Mexico.

This firm is one of the leading distributors for tubular products, Pittsburgh "Seamless" and Central Tube "Lapweld," as well as being factory representatives of the Chapman Valve Manufacturing Company and the Stockham Pipe and Fittings Company. The Taubman Corporation also maintains a used pipe department.

Taubman states that business of the corporation shows a gain of 15 per cent over the same period of last year.

This Baby Has Things "FIGURED"

IT MAY not be significant, but the predominance of such attention arresting numbers as sevens and elevens attending the birth of a son to Mr. and Mrs. H. A. Wienecke may spell disaster to someone if the heir apparent decides to utter a coaxing Wham. The new arrival weighed seven

pounds and eleven ounces; was born seven minutes after seven on the 31st day of the seventh month, 30th year. And if it is desired to carry the sevens a little further, add the numerals in the day and year and the sum is another seven. Mr. Wienecke is an engineer in the mechanical department of the Prairie Pipe Line Co.

Boiler Feed-Water Heaters at Drilling Wells

A SERIES of tests was conducted at a drilling well in the Oklahoma City field recently to determine the possible economies of boiler feed-water heaters at drilling wells. Records of the amount of water recovered and the gain in feed-water temperature were obtained and the results show that the feed-water temperature was raised from 47 to 190 degrees F. and that from 20 to 22 per cent of the total water used was recovered. Records kept on fuel consumption indicated a fuel saving of 9.70 per cent.

Observations made showed a marked improvement in the quality of the water. Analyses of the raw feed-water and the water leaving the feed-water heater show that the total solids were reduced 37.6 per cent and the total hardness 41.7 per cent.

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QUALITY DEMAND alone built the great Central Tube plant at Ambridge, with an annual capacity of more than a quarter million tons of the highest grade steel pipe that modern manufacturing facilities can produce.

Soft, ductile steel . . . ends finished for any type of joint . . . are important factors responsible for the reputation "Central" Wrought Steel Pipe enjoys today.

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Does It Pay to··

Cut Production Costs

If it is advisable to keep production costs down during prosperous times, it is doubly advisable to do so now.

When you use the Drop & Seat you are guaranteed at least 50% saving in valve-check replacements. Pulling costs time and money. The Drop & Seat, reducing replacements by 50%, reduces pulling costs by a similar percentage.

Only the highest grade of materials and the best workmanship are used in the making of the Drop & Seat. Frequent inspections assure a perfect product.

If you do not effect a 50% reduction in pulling costs by employing NO-CO-RO Drops & Seats, Norris Brothers will refund your money. Thus, you have nothing to lose, everything to gain.

Your order sent to any one of Norris Brothers' well-stocked warehouses will receive prompt attention.

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Pipe and Locomotives

by **G. W. SWEET,** *General Supt. South Chester Tube Co.*

THE writer once heard a man, who was on a sight-seeing trip through a large iron foundry, ask where they cast the locomotives. This man was sincere in his assumption that locomotives were all cast in one piece and he was very much surprised when he moved over into the machine shops to see all the care and detail that went into the building of a locomotive.

From the methods used by many in handling and using pipe and casing it is quite evident that they have much the same idea about pipe that this man had about locomotives. There must be just as much care taken in making pipe as there is in building locomotives. Any old kind of steel will not do for making pipe. The steel must be clean and of a free welding quality and yet be stiff enough to stand the strains demanded by present-day practice. Steel for lap welded pipe and casing is continually being improved upon and today tensile strength of 52,000 to 58,000 pounds are obtained. Some of the tools used in making pipe are made to the thousandth part of an inch and in order to keep them to a very close accuracy, costly checking apparatus is used.

A great deal of care and exactness must be exercised with the threads so that they will make up properly in the field. The threads must be as near perfect as possible as to pitch, taper and form so as to make up freely without tearing or gauling.

One of the methods used to keep threads to a close standard of accuracy is to project the greatly magnified image of the thread-chasers on a screen or chart where any slight error or inaccuracy can be detected. In no other line of manufacture is a better system of inspection maintained. From the time the pipe is welded at the welding furnace until it is loaded on the car it is almost continually passing under the eye of an inspector.

It is the duty of some of the inspectors to constantly check pitches and tapers by special tools which register to within one thousandth part of an inch. Other inspectors gauge and inspect each thread. There are still others who thoroughly go over the surface of the pipe.

A lot of care and accurate work must go into the making of a joint and if the pipe could be put in the ground in the condition it leaves the mill, very few complaints would be received.

Before the pipe is passed it is drifted with a very close fitting drift which insures round pipe free from flats and dinges.

A great deal of attention is now being paid to the crop end crusher tests. The crop end from each end of every length is cut off and flattened down under a hydraulic press so as to examine condition of weld and better detect other defects.

The question has frequently been asked whether all pipes are hydrostatically tested. Some seem to have the opinion that only an occasional pipe is tested. Each and every length of pipe is tested to the approved pressure and pressure is held for a long enough time for the entire pipe to be examined.

Notwithstanding all the care the pipe is given in the mill, the writer has seen pipe dropped from cars onto the ground and there dragged several miles over bowlders and through mud and sand tearing rings off, damaging threads and coupling and when the pipe was run in the hole no attempt was made to thoroughly clean the threads or examine the threads and couplings for dinges and other damage. The slightest dinge in a coupling will tear the

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threads on the pipe when the joint is being made up and may cause the joint to part.

The writer has seen one casing crew hammer the couplings with a ball pean hammer as the joint was being made up, every blow causing a small bulge inside the couplings which tear the threads while being screwed up. This company wondered why their casing leaked and why the threads were torn when they pulled the casing to replace the leaking joints. The pipe threads were so damaged that they could not be rerun until new threads were cut. A new string of casing was used and after some persuasion they decided to thoroughly clean and examine all the threads, repairing where necessary and rejecting several joints where damage was too great to repair. The hammer was thrown away and the casing was run in and set in less time than the first string had been run in and it did not leak. Even a very light blow with a hammer or other object will cause a small bulge inside the coupling which will tear the threads on the pipe and when this happens the pipe is blamed and condemned for being too soft and the wires to the mill heat to a cherry red.

The writer visited a well where the pipe had been snaked over the rough ground for considerable distance and when the rings were removed found that the threads were very badly damaged. Several ends had the threads almost entirely ground away due to sand and grit getting under the ring and the rotating action of the pipe in the ring while being dragged over bowlders and other obstacles ground the threads away. In this case every thread was more or less damaged and yet no attempt was made to inspect and repair them before they were run into the hole. Needless to say that the string parted and yet these were the same threads on which so much care had been exercised at the mill.

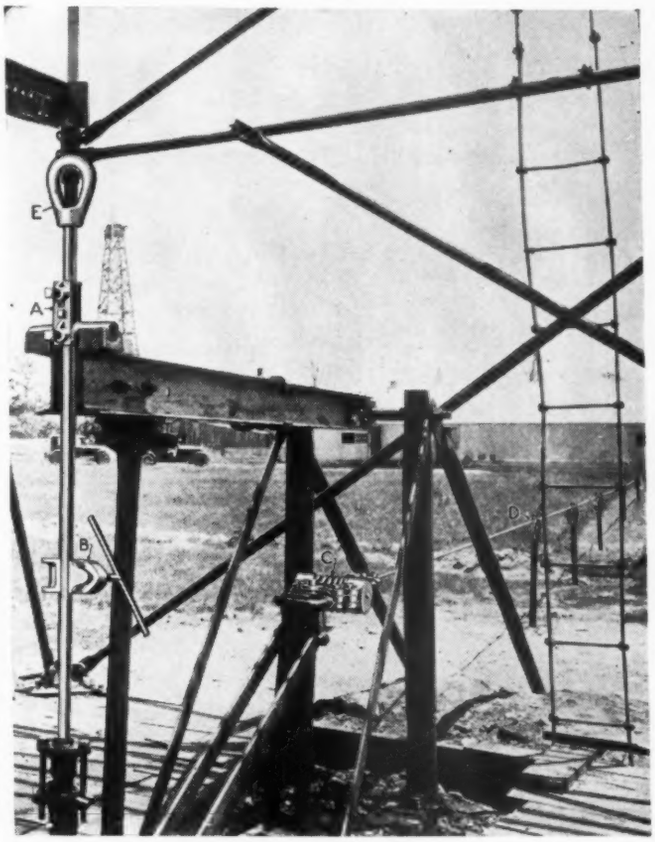
On another occasion the writer watched a number of cars of line pipe being unloaded from an embankment 35 feet high. The stakes were cut and the pipe allowed to drop off the car and roll down the embankment topsy-turvy until they were stopped by some obstacle at the bottom of the incline. When the writer arrived on the scene no less than five cars had been unloaded and most of them were lying in a pile at the bottom of the incline like Jackstraws. They were criss-crossed, standing on end and some even bent almost horseshoe shaped. A Johnstown flood could not have created more havoc. The ends of this pipe had been carefully machined and gauged for couplings, but after unloading it took four men a week rounding the ends up with sledge hammers.

It is encouraging to note that most of the consumers of pipe, especially the larger oil companies, recognize the fact that by the careful handling of casing and line pipe an enormous amount of trouble is eliminated. Trouble means a loss and perhaps a failure which would have been prevented had a little care been taken. It is very rare for a complaint to come from any of the larger oil producers, whereas there are others who seem to encounter trouble with every string of casing they try to run for the simple reason enough attention is not given to the handling. Care means success; carelessness means a failure.

W. W. Patrick Dies

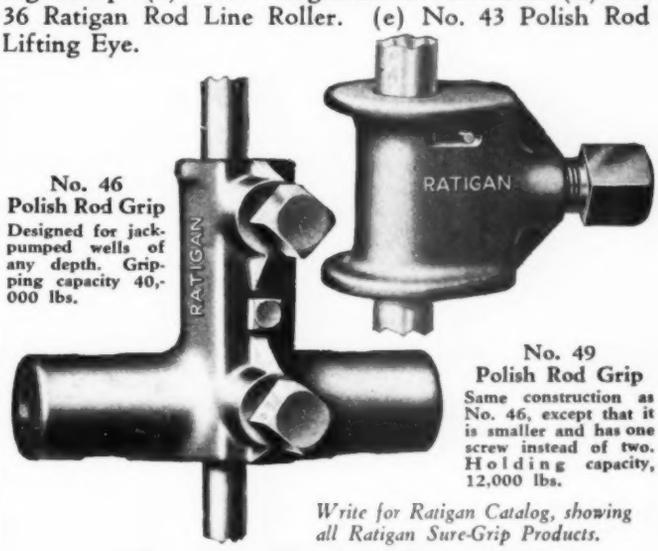
W. W. Patrick, a director of the Foxboro Company, died suddenly, July eleventh, of pneumonia. He was one of the most widely known figures in the instrument business.

He had been associated with the founders of the Foxboro Company since 1899. In 1908, he became New York district sales manager and held that post for twenty-two years.



Jack Well—Equipped with RATIGAN Appliances

A Ratigan-equipped, jack-pumped well under actual working conditions. (a) No. 46 Polish Rod Grip which can be used as shown, or turned upside down for Jensen or similar straight lift jacks. (b) No. 2 Ratigan Spacing Clamp. (c) No. 5 Ratigan Shock Absorber. (d) No. 36 Ratigan Rod Line Roller. (e) No. 43 Polish Rod Lifting Eye.



No. 46 Polish Rod Grip
Designed for jack-pumped wells of any depth. Gripping capacity 40,000 lbs.

No. 49 Polish Rod Grip
Same construction as No. 46, except that it is smaller and has one screw instead of two. Holding capacity, 12,000 lbs.

Write for Ratigan Catalog, showing all Ratigan Sure-Grip Products.

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The Use *of* Centrifugal Pumps *for* Gasoline Pipe Lines

By W. R. LAYNE

ONE of the newest developments in the oil industry is the transportation of gasoline through long pipe lines. This idea first received serious attention in California as early as 1923 when the Standard Oil Company of California pumped gasoline from their El Segundo refinery through 17 miles of four-inch line to Los Angeles harbor. By 1926 there were several gasoline lines in California varying in length from ten to thirty-three miles. In 1927 was built what may be regarded as the first real gasoline pipe line involving all of the features of design, operation and economics connected with the true trunk pipe line.

Gasoline lines are not altogether new, since more than twenty years ago the Gulf Coast gasoline was pumped through a pipe line under conditions tantamount to main line operating conditions.

This line was built by the Shell Company of California and extended from Ventura to Watson, a distance of 97.32 miles, starting from an elevation of 475 feet, climbing over a maximum elevation of 1,622 feet and discharging at an elevation of 42 feet, all above sea level. The capacity of the line was about 6,250 barrels per 24 hours, there being two pumping stations. The initial station at Ventura was equipped with a steam turbine driven centrifugal pumping unit operated at 575 pounds per square inch; the intermediate station at Simi was an automatic electric-driven centrifugal unit operating at 685 pounds pressure. No surge or balance tank was used at the Simi station.

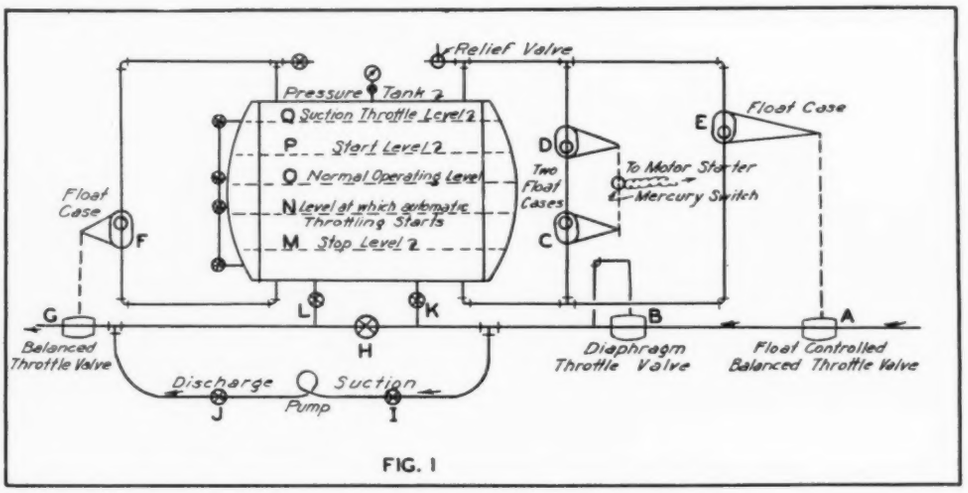
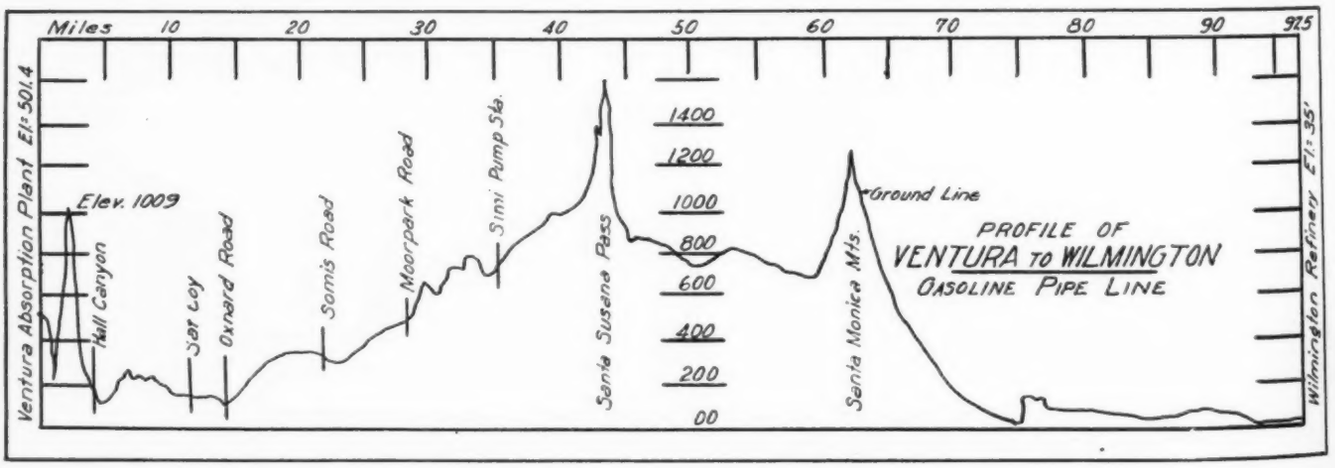


FIG. 1

It is rather interesting that this first gasoline pipe line was equipped with centrifugal pumps. Both rail and water transportation were available between Ventura and Watson, and at that time centrifugal pumps had gained little favor with the oil pipe line operators in general. One of the greatest arguments advanced against centrifugal pipe line pumps had been the relatively low efficiency as compared with reciprocating pumps, and on this pioneer line the pump efficiency was indeed quite low; but even so, this line is said to have paid out the investment in a satisfactorily short time.

On gasoline lines it is very important that there be no leaks or chances of evaporation; therefore, the elimination of surge tanks at the station is desirable.

Special stuffing boxes should be used in conjunction with centrifugal pumps for gasoline work, and they should be so constructed that any leakage past the main packing gland is not allowed to escape to the atmosphere, but is piped back either to the suction side of the pump or to a closed container. If the stuffing boxes are not of the above type, they should be equipped with hoods in which are Venturi devices, actuated by the cooling air from the motors,



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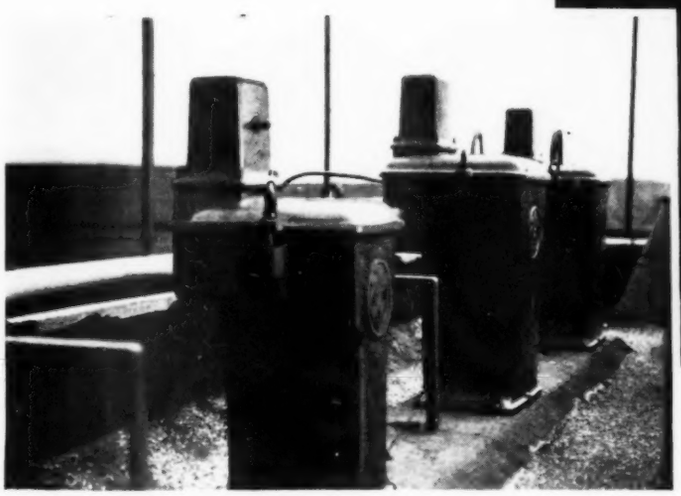
— *because flameproof and weatherproof*



EC&M Oil-immersed Automatic Motor Starters

Every petroleum engineer recognizes that, where explosive vapors are present, he cannot have a surplus of safety—a surplus of protection against a disastrous fire.

It is for this reason that the engineer of this oil refinery, illustrated above, selected EC&M Automatic Oil-immersed Compensators to control his low-voltage motors. Although he had many of these starters working in highly explosive atmospheres, he knew that in this instance, he could save valuable floor space by mounting these starters on the roof of one of the refinery buildings. He knew that this procedure would be perfectly safe, because the oil-immersed construction of EC&M Motor Starters makes them weatherproof as well as flameproof.

For remote control of these starters, he knew EC&M Vaporproof Push Buttons (shown above) or Oil-immersed Master Switches would provide complete safety. Bulletins 1042-G, 1047-A and 1048-P completely describe and explain why EC&M Motor Starters insure 100% safe operation. Write for your copies.

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When writing The Electric Controller & Mfg. Co. *please mention The Petroleum Engineer*

Any Depth Any Load!

Jensen Straight Lift Electric Pumping Jacks are made in four sizes, with motors from 5 to 20 H. P. for pumping wells up to 5,000 feet.

These Jacks can be counterbalanced until the load on both the up and down stroke is the same. It is done by removing the plug at the top of the motor and inserting the balancing crank, then adding counterweights until the desired result is obtained.

The gears are cut and polished for long life, durability and noiseless operation. There is a worm drive to a set of spur gears which drives the crank. This worm gear brings the speed of the motor down to approximately 180 r. p. m., from which speed the spur gears operate with efficiency. The gear reduction runs in an oil bath entirely enclosed. Bearings are Timken, Hyatt and S. K. F.

The motion is the most efficient STRAIGHT LIFT known to the oil country. These jacks have established remarkable records for reducing power consumption and increasing production. May be equipped with gas engine and multiple V belt drive where electricity is not yet available.

An engineer will be sent for consultation on your lease without obligation. Write or wire.

Jensen Bros. Mfg. Co.
COFFEYVILLE, KANSAS, U. S. A.
Export Office: 136 Liberty St. New York City

JENSEN JACKS

STOCKS CARRIED BY:

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Petroleum Equipment Co., 2800 South Alemeda St., Los Angeles, California, California agents.

to suck up and discharge the gasoline vapors outside the pump house. Ventilation may be further assisted by the use of wind-operated Venturi ship-type ventilators on the roof. The use of a fire wall between the pumps and the motors is also good practice.

Centrifugal pump efficiencies have been greatly improved recently and the following tabulation gives a fair idea of the values realized with the best designs on the market today for discharge pressures around 700 pounds per square inch.

Bbl. 24 Hrs.	GPM	Eff. %
6,000	175	45
10,000	292	60
15,000	438	67
20,000	584	72
25,000	730	75

In some individual cases even higher efficiencies may be found.

Fig. 1 shows one example of an automatic control used at present on a motor-driven centrifugal pipe line station.

Operation of Automatic Device

Refer to Fig. 1:

Idle positions:

Closed valves: G, H and L.
Open valves: A, B, I, J and K.
All floats down.

Sequence of operation—Starting up:

Oil flows through A, B, K into pressure tank, filling up to level N and raising float C and F.

Float C is interlinked with float D, but does not operate mercury starting switch as float C rises.

Float F opens valve G to main line and allows oil to pass on through the pump until enough line friction is built up to cause the oil in the pressure tank to rise to level P, which raises float D. Float D closes mercury switch and starts motor and pump.

If pump cannot handle all oil being supplied to pump suction by preceding station, the oil level in the pressure tank rises to level Q, raising float E, which partially closes valve A and thus throttles off some of the oil from the preceding station.

If valve A does not sufficiently throttle off the oil from the preceding station, the oil level rises in the pressure tank and partially closes the diaphragm throttle valve B, still further reducing the oil supplied to the pump.

The rise in pressure at the preceding station caused by the closing of valves A and B is warning to the operators that they are supplying more oil than the automatic station can handle.

During normal operation the oil level stands at level O, with floats D and E down, valves A and B wide open. Float F is up, with valve G wide open.

Shutting down: When the preceding station stops, the pressure is reduced in the pressure tank and the oil level drops to level M. Floats F and C drop.

Float C shuts off motor.
Float F closes valve G.

The system is now in its original position.

When writing JENSEN BROS. MFG. CO. *please mention The Petroleum Engineer*

Associated Oil Company to Join in Building Refinery in Japan

ASSOCIATED OIL COMPANY has joined with the Mitsubishi interests of Japan for the purpose of manufacturing and marketing petroleum products in Japan, according to a statement issued from the office of William F. Humphrey, president of the Associated.

The Mitsubishi Oil Company, Ltd., is being organized for the purpose of carrying on these operations. The new company, with headquarters in Tokyo, will be capitalized for 5,000,000 yen, divided into 100,000 shares of capital stock of the par value of 50 yen each, which will be owned by Associated Oil Company and the Mitsubishi interests jointly.

Under the supervision of Associated engineers, Mitsubishi Oil Co. will start construction of a modern refinery in the near future. Land has already been acquired for this purpose, located on Tokyo Bay between Tokyo and Yokohama. According to plans now being prepared by Associated, the plant will be a complete, modern refining unit, with a capacity of 4000 barrels of crude per day and a cracking capacity of 1500 barrels daily. The refinery will be equipped to manufacture gasoline, distillates, lubricating oil, fuel oil and other petroleum products which will be marketed in the empire of Japan, Korea, Formosa and other portions of the Orient. The crude oil requirements of the refinery will be furnished by the Associated from its California production.

For many years the Mitsubishi Shoji Kaisha, a subsidiary of the parent Mitsubishi company, has acted as distributor of Associated products in Japan, and through the friendly relations thus established the new project was evolved.

New Company to Control Hydrogenation Patents

PURSUANT to plans announced some time ago, Standard I. G. Company, the holding company for the patent rights of the Standard Oil Company of New Jersey and I. G. Farbenindustrie Aktiengesellschaft, of Germany, relating to hydrogenation, has transferred these patents for the United States to Hydro Patents Company, a newly organized Delaware corporation.

The shares of Hydro Patents are held by the following United States oil refining interests: Atlantic Refining Company, Barnsdall Corporation, The Cities Service Company, Continental Oil Company, Mid-Continent Petroleum Corporation, Pure Oil Company, Shell Union Oil Company, Sinclair Refining Company, Skelly Oil Company, Standard Oil Company of California, Standard Oil Company of Indiana, Standard Oil Company of New Jersey, Standard Oil Company of New York, Standard Oil Company of Ohio, The Texas Company, Union Oil Company of California, Vacuum Oil Company.

The share holdings of all of these companies, including the Standard Oil Company of New Jersey, are in proportion to their crude running capacities, with a minimum holding of 500 shares. Control of these patent rights within the United States therefore passes to the prospective users of the process on a pro rata basis.

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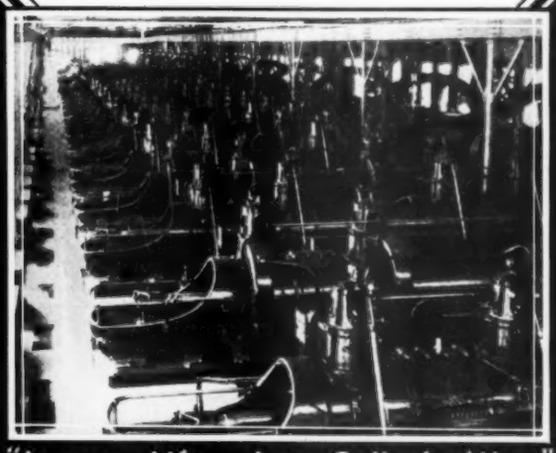
THE STANDARD
IN THE OIL AND GAS FIELDS

It is not merely to hold the pressure that should determine your selection of Piston Rings. You want the certainty that your cylinders will not wear unduly fast. You want, too, a piston ring of long life.

You can turn to COOK'S GRAPHITIC IRON Piston Rings with the assurance that whatever the service, wherever the gas engine, Diesel engine or compressor is located, these rings will provide complete protection against inefficiency.

Used by the representative operators in all Gas and Oil Fields, COOK'S Piston Rings are truly the Standard of the industry.

ASK FOR BULLETIN 130.



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C. LEE COOK MANUFACTURING CO.
INCORPORATED
LOUISVILLE, KY.
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Agents in Principal Cities

Gas Engine Powered Rotary Made Good Time

SOME very interesting drilling figures were made on the Magnolia Petroleum Company's Milo Reed Wildcat test, near Wewoka, Oklahoma. This well not only operated on a scarcity of fuel and water, but made excellent drilling time.

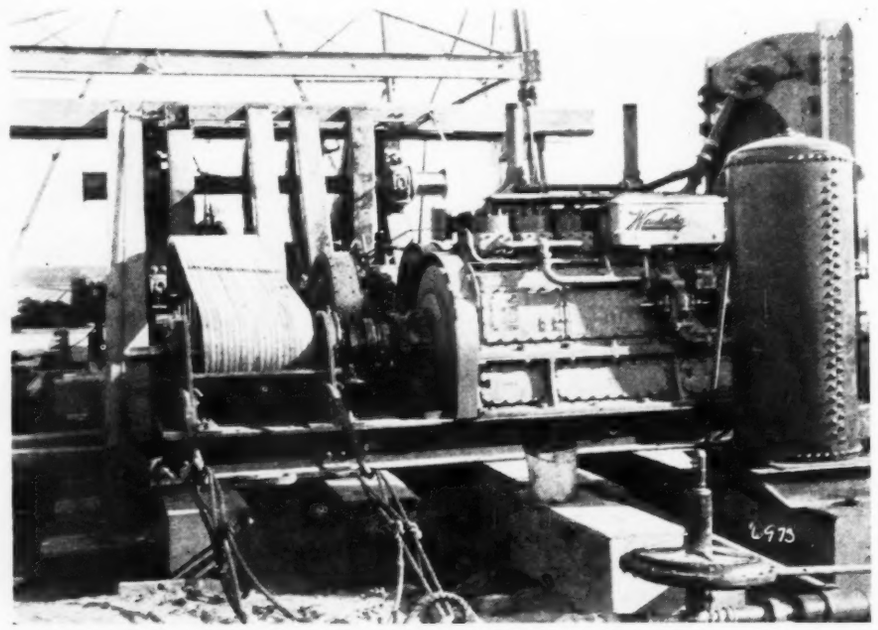
No special equipment in the way of derricks, slush pits or installations were required for the operation of the test. Complete installation was made on 16x16-inch ordinary rig timbers, with all of the equipment secured by means of turnbuckles so that it could be salvaged. In installing the equipment every piece was placed so that as limited a space as possible would be required, and so that fuel piping, manifolds and foundation costs would be reduced to the minimum.

The installation consisted of three gas engines, two slush pumps, and the regular rotary equipped rig. All three of the gas engines were of the same horsepower, rated at 300, which made the equipment standardized and interchangeable in case of emergency.

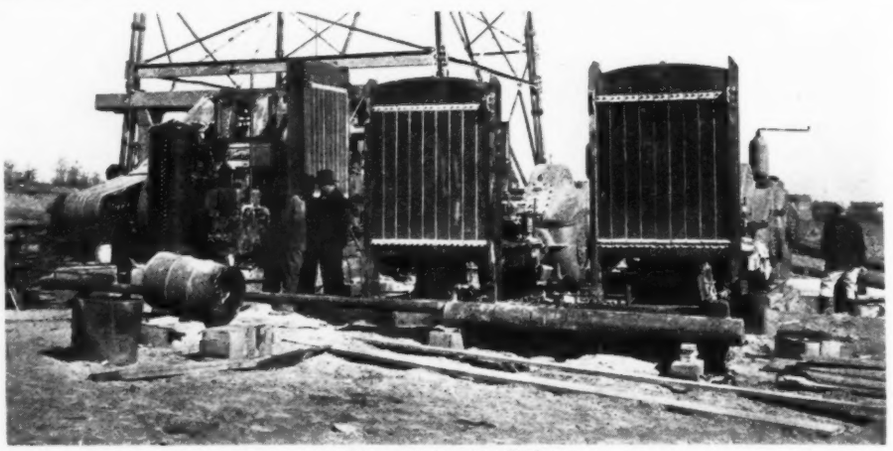
One engine was used for the operation of the rotary table and draw-works. This engine was placed directly in the rear of a four-speed draw-works. It drove the draw-works through a reversible clutch and an 18-string Texrope drive to the draw-works shaft. Since the jack shaft in the draw-works was of steam design, and gas engines were being used, it was necessary for a reduction in speed. The maximum engine speed was 1,000 revolutions per minute and the maximum speed on the reverse clutch was 330 revolutions per minute, or an approximate reduction of three to one from the engine to the clutch. Further reductions in sprocket sizes from the clutch to the jack shaft slowed the jack shaft speed more. No special design of sprockets were used, all being standard steam sizes.

The slush pumps were placed between the rig floor and the slush pits, in parallel lines to reduce the required space, foundation costs, etc. The engines drove the pumps through a series of gears with a final reduction of twenty to one from the prime mover to the pumps. This furnished one pump for mud circulation and the other as a spare for emergencies.

The Magnolia Petroleum Company's statement of the amount of gas delivered to the well for fuel by the Wewoka Fuel Plant shows that during the month of April a total of 1350 million cubic feet were consumed. The well was drilling 26 days during this month, making its daily average gas fuel consumption 52 million cubic feet. The largest amount of gas delivered on any one day of this period was on April 22nd when 67 million cubic feet was consumed.



Photograph showing draw-works and engine drive.



The complete installation.

The daily average amount of water consumed during the same period of time was from 150 to 200 barrels. This was quite an important feature because of the scarcity of water at the location.

Including the time spent in rigging up, several days spent in coring, one day in fishing, and several waiting on cement to set, the well reached a depth of 3361 feet in 42 days, of which 29 days were spent in drilling. This is an average of 1100 feet per drilling day.

This same equipment is now drilling another test for the Magnolia Petroleum Company. It is near Sparks, in Lincoln County, Oklahoma. This time it will be drilled to a greater depth, due to the probable testing of the Chandler pool producing horizon, which is found about 5000 feet below the surface. C. F. Camp Co. was largely instrumental in the development of this equipment.

The accompanying photographs made on the Milo Reed well show the hook-up and views of the equipment that was used in drilling this well and now being used at Sparks.

The Volatility of Motor Fuels

THE Department of Engineering Research of the University of Michigan, Ann Arbor, Mich., has just received from the press its latest publication, "The Volatility of Motor Fuels," by Dr. G. G. Brown. This book was summarized in the May issue of The Petroleum Engineer by Dr. Brown under the title of "Determining Motor Fuel Performance." The price of the book is $1.00.

New Welding Literature

THE Linde Air Products Company, 30 East 42nd St., New York City, has recently published two new pamphlets as a part of the Linde Process Service.

"Outline Training Course for Aircraft Welders" is an outline of instructions for aircraft welders based on procedure control. This training course applies the principles of procedure control to aircraft welding and also outlines qualification tests for aircraft welders.

"Production Welding" illustrates and describes the application of the oxy-acetylene process as a production method in a number of the more important industries. It shows clearly the application of procedure control in production operations.

New Universal Oil Booklet

"HOW Cracking Produces Gas from Heavy Oils," presented by Dr. Gustav Egloff at the recent meeting of the American Gas Association in Cleveland, Ohio, has just been printed as U. O. P. Booklet No. 77 and is just off the press. Free copies of this booklet may be obtained by addressing Universal Oil Products Company, 310 S. Michigan Blvd., Chicago, Ill.

The new Trackson trench roller, which eliminates hand tamping and puts back all of the dirt over newly laid pipe lines, is described in an attractive circular which may be obtained by writing the Trackson Co., 1319 So. First St., Milwaukee, Wis.

Resistance Thermometers Literature

LEEDS & NORTHRUP COMPANY, Philadelphia, Pa., has issued the 1930 copy of Catalog No. 80, "Resistance Thermometers."

This is a revised edition of a previous issue, and it treats in detail of L. & N. Resistance Thermometers for recording, controlling, and indicating temperatures. Considerable space is devoted to heating and ventilating applications, applications in refrigeration and chemical plants, in gas-making and other comparatively low temperature applications.

Precision equipment is listed, temperature difference equipment, thermometer indicators, thermometer recorders, and thermometer controllers with accessories.

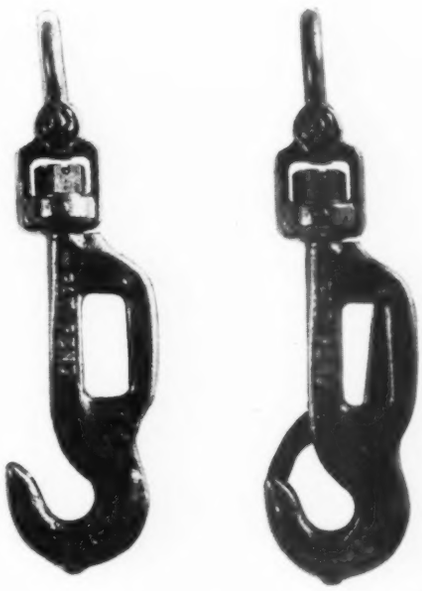
Taking Evaporation Loss Out of Oil Storage Costs

THE July issue of "The Water Tower," published quarterly by the Chicago Bridge & Iron Works, Chicago, carries a very interesting article on the economics of oil storage under the heading, "Taking Evaporation Loss Out of Oil Storage Costs."

SKINNER BROS.

Sucker Rod Hook

is safe to use



Moving latch in handle three-eighth of an inch unlocks keeper over opening, an additional three-eighth inch entirely opens hook for removal of elevator bail.

Drop forged bail and cottered bolt at top does away with S or C links, making the hook lighter and safer to handle.

Swivels on roller bearing on a machined seat. Seven and one-half ton capacity weighs twenty-one pounds.

Try one, return if not satisfactory.

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TULSA, OKLA.

When writing SKINNER BROS. BELTING CO. *please mention The Petroleum Engineer*

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QUASI-ARC Electrodes are unequalled for boiler welding or other work subject to stresses at high temperatures and for joints requiring high resistance to shock and fatigue caused by alternating stresses. Write for technical folders describing the unique features of Quasi-Arc welding.

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MANUFACTURERS OF
OILFIELD WINCHES, PIPELINE WINCHES AND BACKFILLERS
Auxiliary Equipment For "Caterpillar" Tractors
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8—250 gal. capacity Paint Pots
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7—Fordson Tractors equipped with full crawlers and booms
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Tents, flies, blankets, iron cots, Frostkiller heating stoves, kitchen ranges, cooking and tableware.

Uinta Pipe Line Company
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Regan Booklet Contains Much Information

HOW to string the wire line from traveling to crown block, how to assemble the crown block on the top of the derrick, and a great deal of other valuable information is embodied in two bulletins just released to the industry by the Regan Forge & Engineering Co. of San Perdo, California. The bulletins feature type A and B crown blocks and show various types of hook-ups, illustrating 4, 6, 8, 10 and 12 string-ups.

These booklets comprise part of a series of catalogs that are being released to the industry featuring the firm's various products.

L. & N. Relative Humidity Recorder

THE L. & N. Relative Humidity Recorder, described in Bulletin No. 880 of the Leeds & Northrup Company, Philadelphia, Pa., is a new departure in recording humidity. The usual psychometric device measures the temperatures of wet and dry bulb thermometers in a current of air, but the observer must find the corresponding humidity from a table or chart showing the relationship. The unique feature of the instrument described in this bulletin is that it records relative humidity directly. The manner in which this is accomplished is explained in the text.

T-I-W Tubing Slips and Spiders

A PAMPHLET describing and illustrating the T-I-W Tubing Slips and Spiders manufactured by the Texas Iron Works Sales Corporation of Houston, Texas, has been received. This booklet is very concise in giving dimensions and specifications of these pieces of equipment.

Continental Turbine Pump

A NEW illustrated catalog containing a complete description and working details of the Continental Turbine Pump has just been issued by the Continental Equipment Company, Inc., of Los Angeles.

Among other features of interest in the book is its explanation of how the pump utilizes the atomizing principle to lift oil more efficiently and how it is adaptable to various pumping conditions.

Safety Appliance Bulletin

THE Mine Safety Appliance Co., of Pittsburgh, Pa., has issued a bulletin illustrating and describing its various articles for first aid training and contests. This company makes bandages, splints and many other articles and solutions for use in case of accident.

Handbook of the Petroleum Industry

THE Taylor Instrument Companies, Rochester, N. Y., has published a heavily bound book of 190 pages called "The Handbook of the Petroleum Industry." This book carries many interesting features that should be of interest to the oil man.

It is divided into three main sections, the production of crude petroleum, the refining of crude petroleum and the manufacture of natural gas gasoline. Instruments used in these various departments that are made by The Taylor Instrument Companies are illustrated and described, as well as the companies' instruments for laboratory practice. The book contains many charts that carry interesting and important data.

RESPONSIBILITY

« « » »

IN this age of specialization it is well to reflect occasionally on this thought:

Exactly what is the natural gasoline plant builder's responsibility to the producer? Does his responsibility end when the first graduate of gasoline comes through?

Were this the case, the gasoline plant might well be put in the category of the washing machine; it is delivered, first payment accepted, and then the installer is free to give all his time to the next prospect.

But the correctly designed gasoline plant, like the human body, is a highly specialized organism, every part bearing a definite relation to every other part. Each installation constitutes a special case.

Here is where the responsibility-conscious plant builder comes in. The tuning up of one of his plants—and its subsequent perfect functioning—is every whit as much his duty as the designing and construction of the plant itself.

In buying a gasoline plant, the producer is buying gasoline. The plant that produces a maximum of quality gasoline at a minimum of cost (properly designed plants cost less to maintain) is the plant that every foresighted producer is looking for.

Campbell-built plants are extracting 20% of all the natural gasoline produced in California. Of 32 plants built in that state within the last six years, 19 represent repeat orders.

Campbell engineers follow every one of their plants through, just as the old family doctor used to follow through "his" babies. Campbell maintains a rigid inspection service, his responsibility to the producer.

Write for Bulletin No. 7. It explains the Campbell system.

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Alnapos for treating raw feed water is extremely efficient and economical. A small amount a day will act as a preventive against pitting on tubes, will throw down scale so that it will not form on tubes or inside boiler walls. Samples on request.

Water analysis and suggestions from our engineering department are a part of our service to the industry.

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Built to last... you will always be assured of a fresh supply of pure water, when you have a GOTT Water Cooler. Order one now from your supply store.
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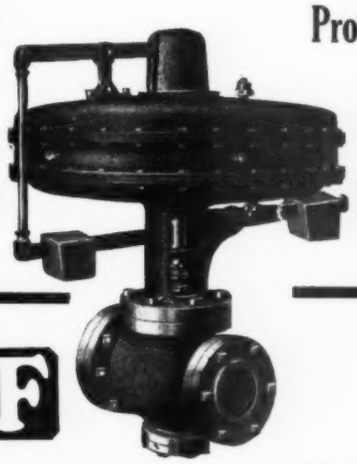
Relief for Your Tanks



Protection for Your Meters

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Vacuum Relief Valve

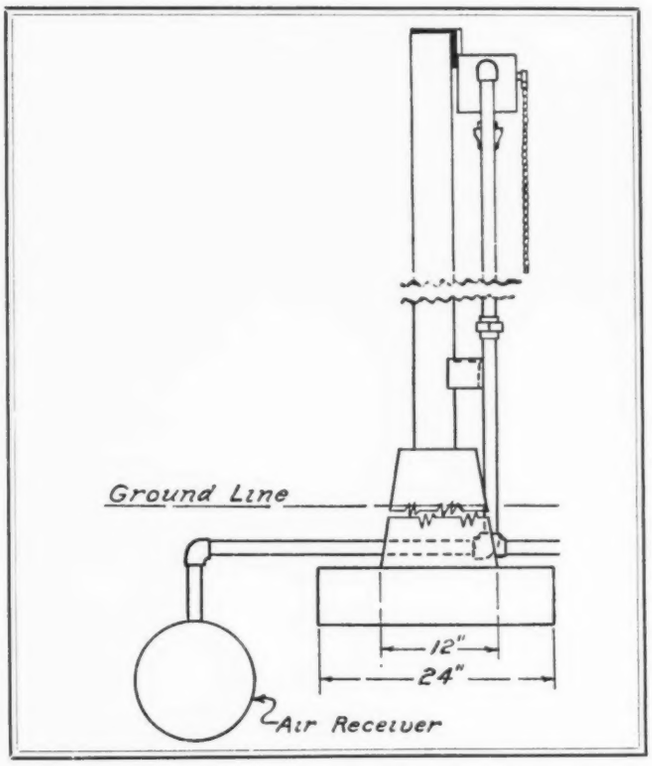
In case of line stoppage or other causes that result in the pulling of a Vacuum in storage tanks and purifiers, this Regulator comes quickly to the rescue. It is placed in a line between suction and discharge of compressor so that, should the pressure in the suction line to the compressor drop to zero, the Relief Valve will open and relieve the vacuum tendency. For a vacuum of 8 ozs. or less, use the Duplex Regulator shown above. For higher vacuums use the single diaphragm Vacuum Relief. Action is reliable. Thousands of meters and tanks have the constant protection which this C-F offers you.

Data upon request.

The CHAPLIN-FULTON MFG. COMPANY
Manufacturers of Regulators for Industrial Gas Service
28-40 Penn Avenue Pittsburgh, Pa.

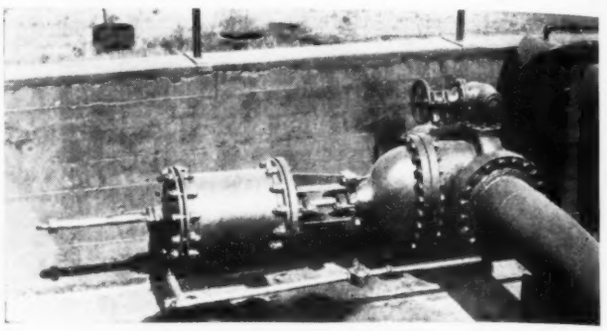
Remote Control Valves Used

WHEN the Magnolia Gas Co. built its compressor stations for its lines running from Louisiana fields to the Gulf Coast and Dallas, Texas, engineers designed a remote control air-operated safety valve for suction and discharge lines. The valves are for emergency use only and they are operated from a stand outside the station building. Details of their layout and operation may be gained from the accompanying drawings and photos.



Receiving tank and stand detail.

Valves on the suction and discharge lines were installed horizontally instead of vertically. The wheel and stem were removed and a piston stem with a packing gland substituted. This stem was connected to the piston of an air cylinder which was bolted to the valve bonnet. Two air lines, controlled by air valves from the stand and leading from a 150-pound air receiver floating on the engine starting tanks, extended to the air cylinder. One opens the gate



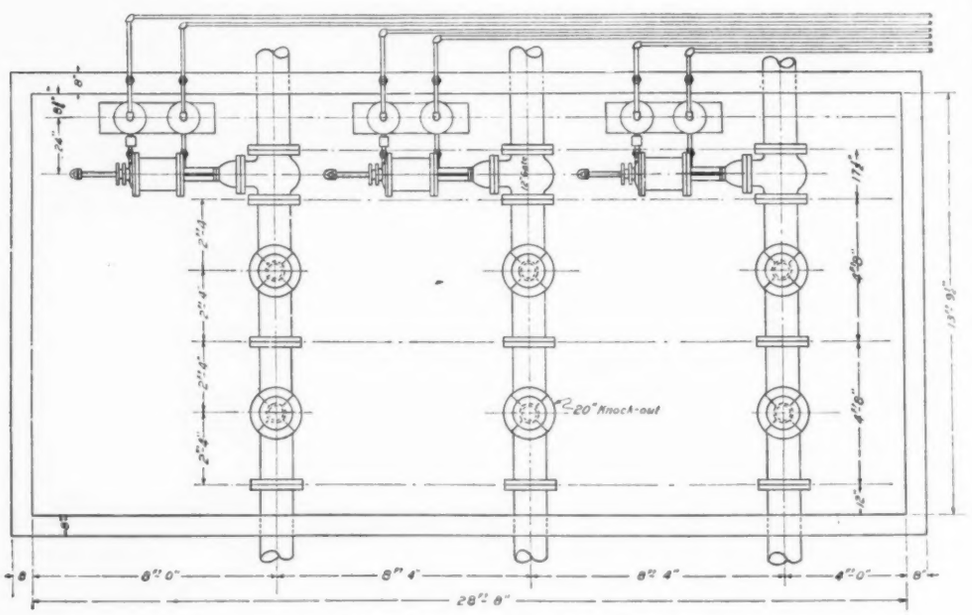
Air cylinder on suction valve.

and the other closes it. To insure against sticking valves, oil reservoirs were set up near the air cylinders and the air pressure forces the oil from the reservoirs to the cylinder piston to serve the dual purpose of operating the piston and lubricating it.

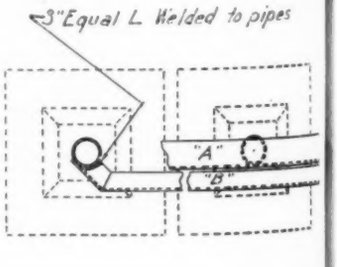
The air receiving tank was built in a pit beneath the valve stand. A pressure of 150 pounds is maintained in the tank from a line, with a check valve in it, to the starting air tanks, which are checked hourly. Lines lead from the receiving tank to the three-way valves on the stand and two lines from each valve extend to the air cylinder.

To control the opening or closing speed of the gate valves each line leading to the air cylinder is equipped with a speed control box containing orifice plates. With this control feature the opening or closing time of the gate may be regulated within a range of from 5 to 12 seconds. The orifice plates in the control box are easily changed.

When the valves were first tried several tests were made. Under one test on the larger gates it was found that 90 pounds pressure in the air re-



Remote Controls and Knock-outs for Suction Lines

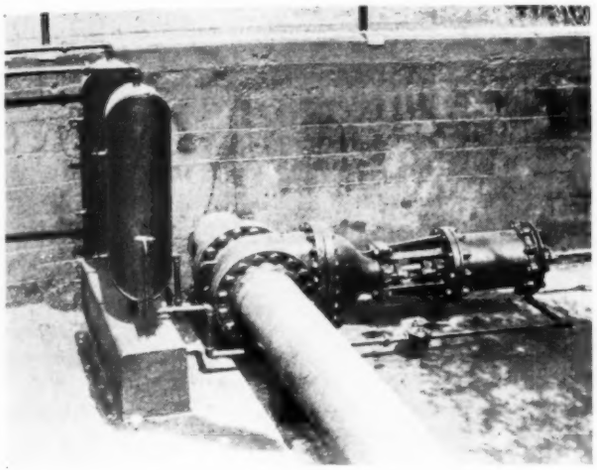


Plan of Control

for Gas Station Emergencies

ceiving tank would operate the air cylinder and close an 18-inch gate against 500 pounds pressure in a gas line.

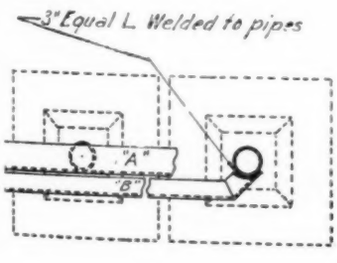
On experimental installations the valves were put in vertically. This practice was soon abandoned because of the valve disc dropping down into its seat under its and the piston weight. To build future installations in this manner



Air cylinder on discharge valve.

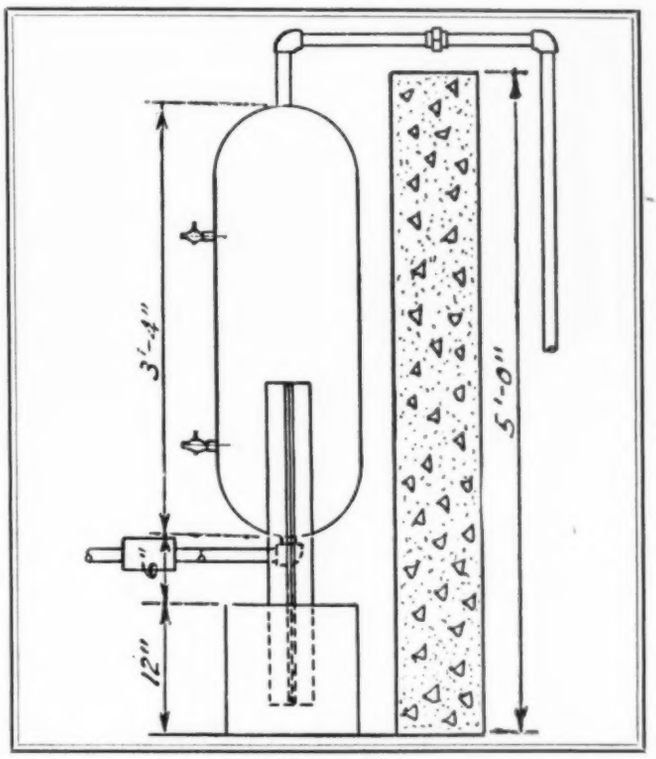
would have required additional safety features to prevent the valve from falling closed. Consequently, it was decided to install the valves in a horizontal position in order to overcome this hazard.

Following several months operation with the valves in a horizontal position, it was noted that these particular gates were not giving any trouble from worn seats. Valves installed in the conventional manner showed some wear under similar operating conditions. Investigation revealed the horizontally installed valves did not furnish the trap for sand and dust which the vertically installed valves did. Therefore, when the valve was cracked and gas started traveling through at a high velocity, it did not have the accumulation of sand and dust in the seat to cause a sand blasting effect such as is the case in a vertically installed valve with the seat on bottom center.

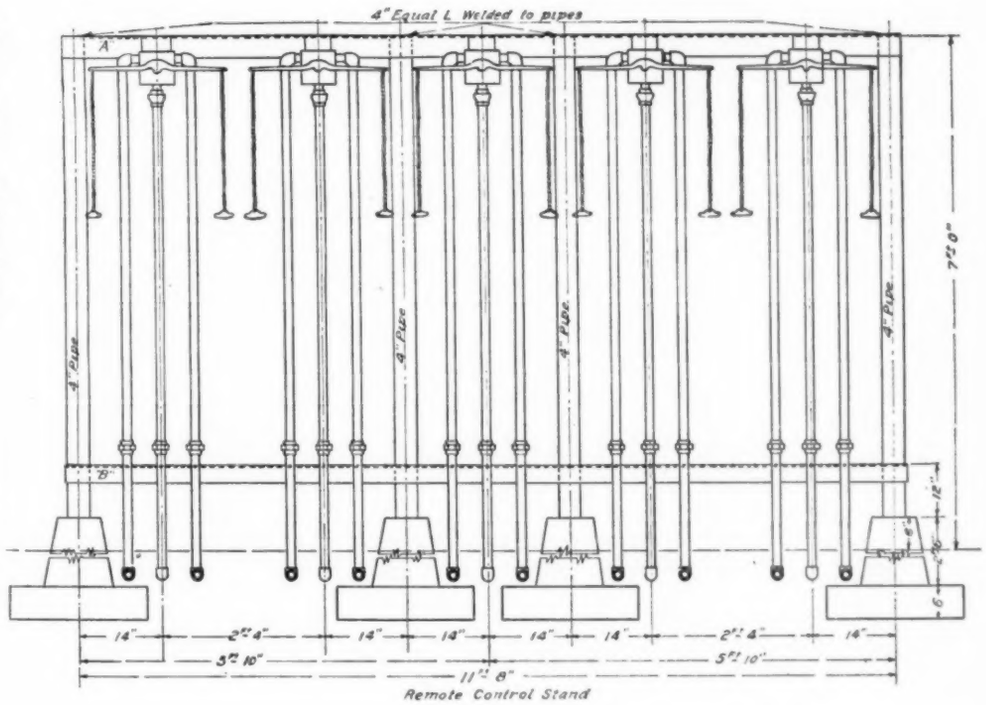


Stand Frame-work

With this installation the stations have a safety feature in the event of fire or other emergencies by which discharge and suction lines may be quickly shut off from the station. The oil reservoirs ahead of the air cylinders insure against a sticking gate. The remote control device is checked periodically.



Detail of oil reservoirs.



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Right here in your midst is an organization that specializes in Pressure Regulators.

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of Sensitive Pressure Control Apparatus. A Regulator for Every Service. Give us your Pressure Control Problems.

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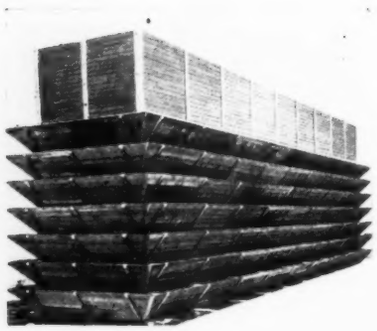

Marley water cooling equipment has won nation-wide acceptance by its continued efficient operation, low operation and maintenance expense—and reasonableness in cost. This fact is evidenced by the large number of Marley Ponds, Towers, Nozzles, etc., in use by the major oil companies.

MARLEY SPRAY NOZZLES

Marley Non-Clog Spray Nozzles provide fine uniform spray at low pressures because of their simple design and large free passages without internal parts. Made in a wide range of sizes for various capacities. Descriptive catalog on request.

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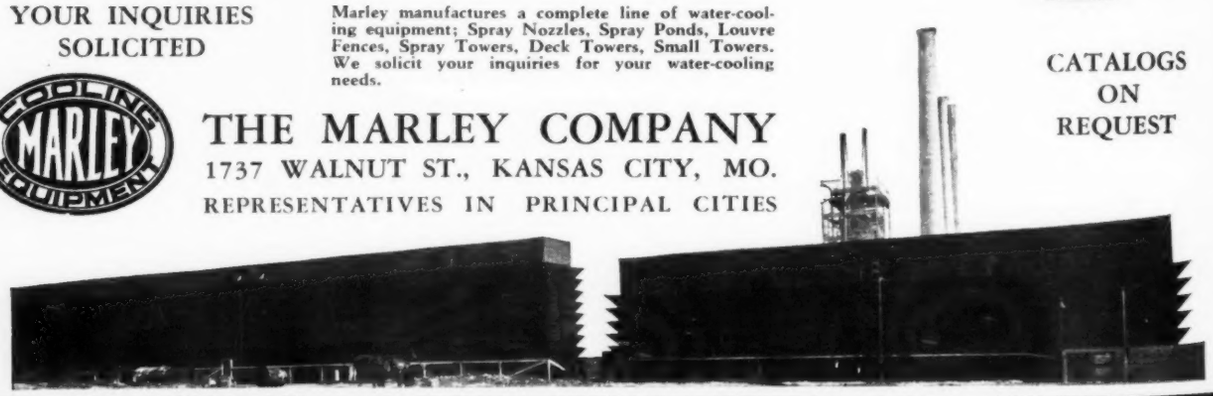
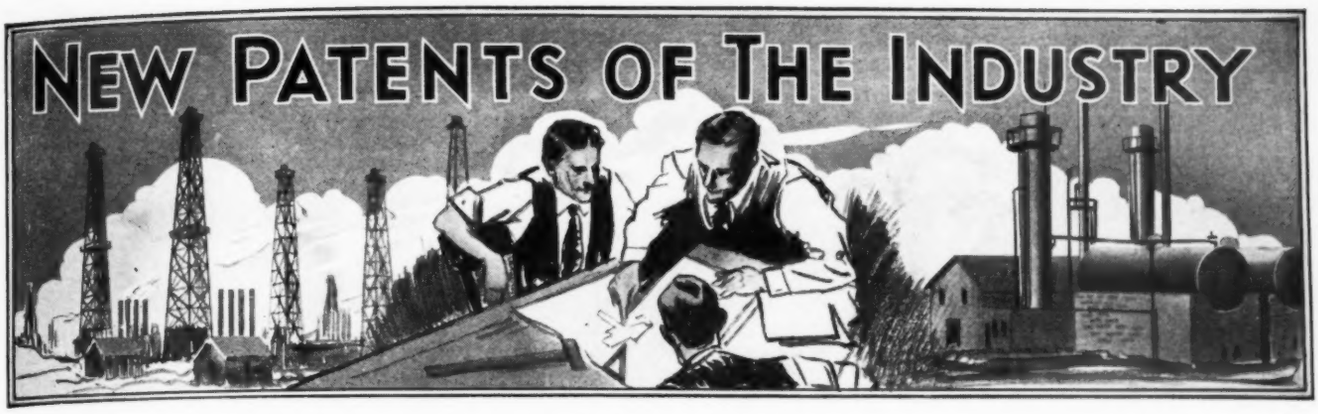
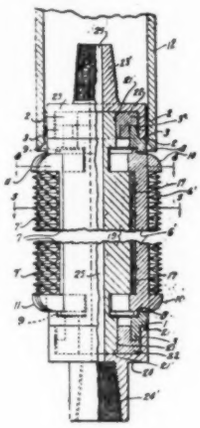
THE MARLEY COMPANY
1737 WALNUT ST., KANSAS CITY, MO.
REPRESENTATIVES IN PRINCIPAL CITIES

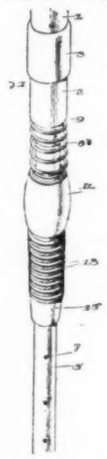




1,764,133. UNDERREAMER. EDWIN C. WEISGERBER, Long Beach, Calif., assignor to John Grant, Los Angeles, Calif. Filed Jan. 18, 1927. Serial No. 161,758. 9 Claims. (Cl. 255—74.)

1. An underreamer comprising a housing having longitudinal openings therein, a plurality of reaming members within said housing and normally extending into said openings, said members provided at each end with milling cutters, a stem extending through said housing and provided with means for causing said cutters to move outwardly, means interlocking said housing and stem, and means engaging said interlocking means and formed for connection with a drill pipe.



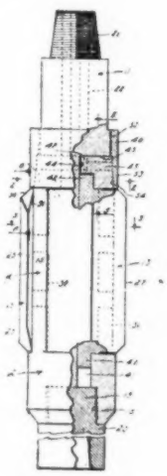


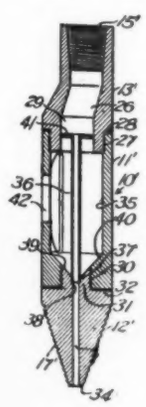
1,771,556. PACKER FOR WELL-TESTING DEVICES. ERNEST H. COX, Duncan, Okla. Filed June 6, 1927. Serial No. 196,758. 6 Claims. (Cl. 166—1.)

1. In an oil well testing device including a perforated tube and a relatively movable perforated sleeve, a packer secured to the upper end of the sleeve and adapted to serve as a stop to limit downward movement of the sleeve, and an additional packer secured to the sleeve below said first-mentioned packer.

1,764,377. REAMER. HARRY P. WICKERSHAM, Brea, Calif., assignor to Henry George Yahraus, Los Angeles, Calif. Filed Dec. 21, 1922. Serial No. 608,164. 5 Claims. (Cl. 255—76.)

1. A tool of the character described including, a body, end parts in connection with the ends of the body, one of the end parts having a round opening, the other having a recess, a cutter adapted to be arranged at the body, trunnions on the ends of the cutter, one adapted to extend into the opening, the other adapted to extend into the recess, a block adapted to be arranged in the recess to retain the trunnion therein, and a sleeve screw threaded onto the end part having the recess to engage the block to hold it in the recess.



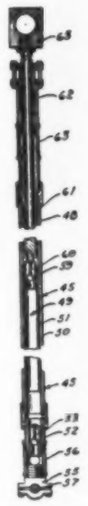


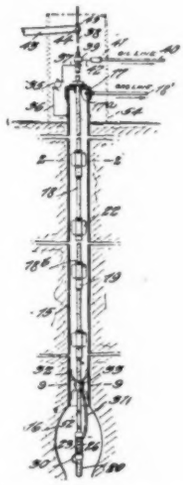
1,763,703. OIL-WELL FISHING TOOL. FRANK J. HINDERLITER, Tulsa, Okla., assignor to Hinderliter Tool Company, Tulsa, Okla., a Corporation of Oklahoma. Filed May 25, 1927. Serial No. 194,015. 16 Claims. (Cl. 294—113.)

1. In combination in a tool for removing broken drill parts and the like from a well, a member adapted to be lowered to the bottom of a well and having a pocket for receiving a broken drill part and means connected with said member operable to displace the broken drill part from the bottom of the well and to cause the part to crawl upwardly alongside said means into said pocket.

1,764,473. LIQUID PUMP. BERNARD H. SCOTT, Glendale, and SAMUEL E. ROSS, Long Beach, Calif., assignors to Scott-Ross and Company, Los Angeles, Calif., a Corporation of Delaware. Filed July 20, 1926. Serial No. 123,629. 1 Claim. (Cl. 103—159.)

In a pump of the character described, the combination of: a pump barrel; means for pivotally supporting said pump barrel; a pump plunger adapted to reciprocate in said pump barrel; a crank attached to said pump plunger for reciprocating said pump plunger in said pump barrel; a flexible inlet for said pump barrel; a swivel joint positioned on the pivotal axis of said pump barrel; and an outlet for said pump barrel connected to said swivel joint.

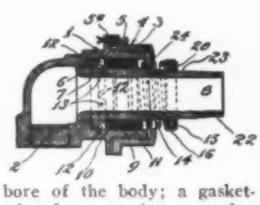




1,764,213. CONDUCTOR FOR OIL-WELL HEATERS. GEORGE WASHINGTON KNOX, Oklahoma City, Okla. Filed Feb. 21, 1927. Serial No. 169,983. 6 Claims. (Cl. 103—1.)

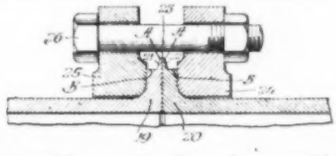
1. An oil well heater comprising an electric heater, a well casing, pump tube therein, means for insulating the pump tube from the well casing, means for electrically connecting the heater and casing including brushes mounted on and insulated from the tube engaging the said casing, and a conductor from said brushes to the heater, means for electrically connecting the heater and tube, and conductors from a source of electricity to the casing and tube.

1,770,609. PIPE JOINT. ALOYSIUS M. FRAUENHEIM, Pittsburgh, Pa. Filed May 16, 1927. Serial No. 191,622. 5 Claims. (Cl. 285—9.)



1. In a pipe joint comprising a body having a cylindrical portion bored to two diameters, a sleeve-member movable within said body and fitting partly within the smaller bore thereof; a collar positioned on the sleeve-member and engaging the larger bore of the body; a gasket-ring and a follower-ring slidably mounted on the sleeve-member; a gasket positioned intermediate the gasket-ring and the follower-ring; means to exert pressure on the follower-ring; spacer means positioned between the collar and the gasket-ring, and means to introduce fluid pressure in the space intermediate said collar and gasket-ring.

1,771,739. PIPE JOINT. IRWIN L. WISE, Chicago, Ill., assignor to Sargent & Lundy, Incorporated, Chicago, Ill., a Corporation of Illinois. Filed May 21, 1926. Serial No. 110,680. 6 Claims. (Cl. 285—140.)



1. A coupling comprising a pair of members provided with circumferential welding collets having the circumferential margins of their opposed faces disposed in abutting relation and secured together by welding at their outer edges, the circumferential edges of said collets being thinner than the bases of the collets and sufficiently thin to permit the welding of said edges together without transference of heat to the body of the joint in such quantities as to cause distortion of the joint.

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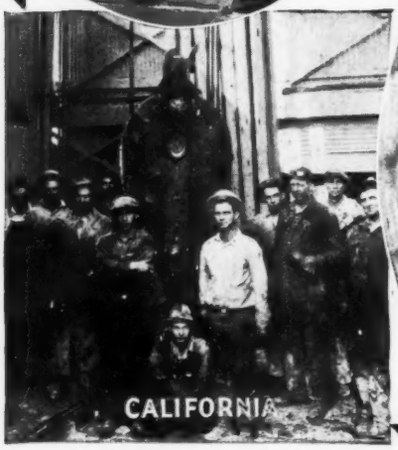

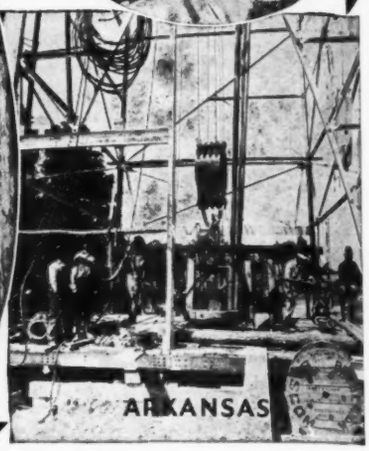

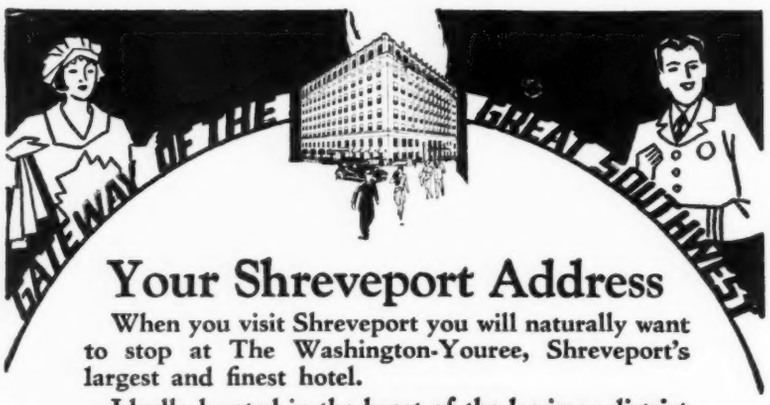

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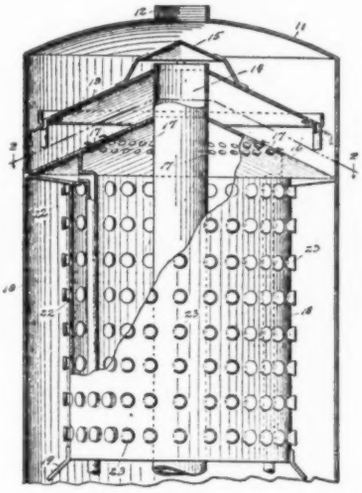
1,764,364. PUMP AND METHOD OF PACKING THE SAME. Roscoe W. Stephens, Los Angeles, and Charles E. Wilcox, Anaheim, Calif., assignors of one-fourth to Charles Drader, Beverly, Calif., and one-fourth to Earl W. Bailey, Bakersfield, Calif. Filed July 16, 1927. Serial No. 206,311. 14 Claims. (Cl. 103—204.)

1. In a pump, the combination of: a barrel having a standing valve; a pump delivery tube; a plunger adapted to operate in said barrel, said plunger having a traveling valve discharging pumped fluid into said delivery tube; and means subjected to the pressure of the pumped fluid and supplying an additional pressure for forcing an abrasive excluding fluid medium through the space between the external surface of said plunger and the internal surface of the barrel with more pressure than the pressure of the fluid being pumped.



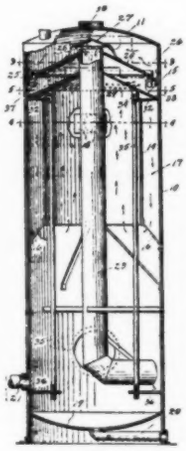
1,770,774. SKIRT FOR OIL AND GAS SEPARATORS. Lewis M. Hackett, Oklahoma City, Okla., assigner to American Tank Company, Oklahoma City, Okla., a Corporation of Oklahoma. Filed Aug. 17, 1927. Serial No. 213,493. 2 Claims. (Cl. 183—2.7.)

2. A skirt for an oil and gas separator comprising a cylindrical body open at its lower end and closed at its top by an apertured baffle and having portions upset therefrom at the outer periphery of the body to form openings and deflectors, said deflectors being connected with the edges of the openings by shanks at an angle to the body and including plates bent at an angle to the shanks and extending circumferentially of the outer periphery of the body in the direction of the flow of an influent.

1,770,773. OIL AND GAS SEPARATOR. Lewis M. Hackett, Oklahoma City, Okla., assignor to American Tank Company, Oklahoma City, Okla., a Corporation of Oklahoma. Filed Aug. 17, 1927. Serial No. 213,492. 7 Claims. (Cl. 183—2.7.)

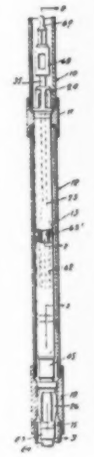
5. In an oil and gas separator, an inclined baffle having ports therein, and deflectors cut and bent upwardly from said ports and each including a shank by which it is connected to the baffle, and a plate overhanging the port and disposed substantially parallel thereto.

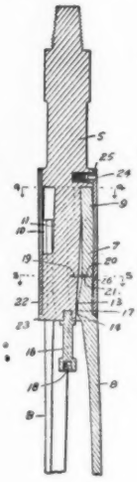
7. In an oil and gas separator, a vertical tank, a conical baffle in the upper portion thereof joining the tank wall, a skirt beneath said baffle and spaced from the tank, inlets into the tank communicating with the space between the skirt and tank, said baffle having ports and deflectors above said ports disposed to direct a flow of fluid outwardly toward the tank, a solid baffle in the tank above the first baffle and spaced from the tank wall, a gas outlet flue leading from above the upper baffle, and an oil outlet from the tank.



1,764,075. LOCK-BOTTOM PUMP. Robert W. Gunn and Willsie A. S. Thompson, Los Angeles, Calif., assignors, by mesne assignments, to Emsco Derrick & Equipment Company, Los Angeles, Calif., a Corporation of California. Filed Dec. 7, 1927. Serial No. 238,265. 23 Claims. (Cl. 103—181.)

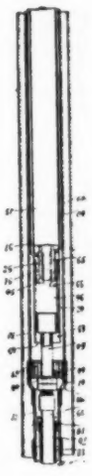
1. A gripping member for lock-bottom pumps and the like, embodying a tubular mandrel, a sleeve encircling the mandrel, said sleeve being slit longitudinally from one end thereof to provide a plurality of spring fingers forming together a radially resilient portion of the sleeve, said fingers having an appreciable inherent tendency to spring radially away from the mandrel at their free ends, and a radially extending keeper member on the mandrel adapted to engage the free ends of the fingers to limit outward radial movement of said fingers, said fingers having gripping portions which extend radially beyond the keeper.





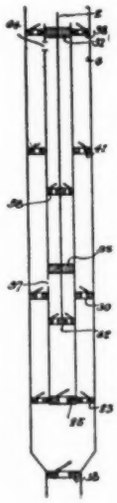
1,771,808. FISHING TOOL. Verne Monroe, Cameron, W. Va. Filed Aug. 6, 1926. Serial No. 127,553. 6 Claims. (Cl. 294—110.)

1. The combination in a device of the type described of a tool head, provided with circumferentially spaced longitudinally extending grooves, a circular recess above said grooves, tool elements having shanks and T-heads slidably mounted in said grooves and recesses respectively, the engaging surfaces of said elements and tool head being formed so as to spread said elements upon movement thereof in one direction relatively to said tool head and to contract said elements upon movement in the other direction, holes in said elements and said tool head adapted to coincide so as to receive breakable pins for normallly holding said elements in one position.



1,764,482. FLUID-OPERATED PUMP. Paul F. Yungling, Los Angeles, Calif., assignor to Scott-Ross and Company, Los Angeles, Calif., a Corporation of Delaware. Filed Mar. 20 1928. Serial No. 263,105. 10 Claims. (Cl. 103—46.)

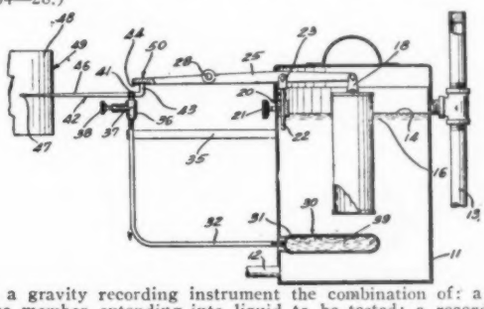
1. A fluid-operated pump comprising a vertical tube provided at its upper end with a strainer, a power fluid induction tube slidably engaging the first mentioned tube and spaced from the strainer, pump tubing surrounding the tubes and spaced therefrom, and a means within the pump tubing operable by fluid pressure within the first mentioned tube to pump a fluid through the pump tubing.



1,761,355. MULTIPLE PUMPING UNIT. Clyde McKissick, Sand Springs, Okla. Filed Mar. 7, 1929. Serial No. 345,060. 1 Claim. (Cl. 103—184.)

A multiple pumping unit of the character described comprising a casing, aligned upper and lower working barrels disposed in the casing and of less diameter than said casing having ports in the upper portion thereof, a working valve mounted for reciprocation in the lower barrel, a piston mounted for reciprocation in the upper working barrel having a drain valve therein for draining fluid which may leak past the piston and accumulate in the lower part of the upper working barrel, a partition extending between the lower working barrel and the casing having a check valve therein and disposed below the port in said working barrel and a partition extending between the upper working barrel and the casing having a check valve therein and disposed above the port in the upper working barrel.

1,770,559. GRAVITY-RECORDING INSTRUMENT. Jack Francis Mahon Taylor, Dominguez, Calif., assignor, by mesne assignments, to Shell Development Company, San Francisco, Calif., a Corporation of Delaware. Filed Jan. 18, 1928. Serial No. 247,599. 6 Claims. (Cl. 234—28.)



1. In a gravity recording instrument the combination of: a buoyancy responsive member extending into liquid to be tested; a recording member; mechanism connecting said members; and temperature responsive means disposed in close proximity to said liquid, said means being adapted to modify the movement of said recording member relative to said buoyancy member and said connecting mechanism to alter with uniform accuracy an indication to be recorded by said recording member so that said indications is correct for a standard temperature of said liquid.

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